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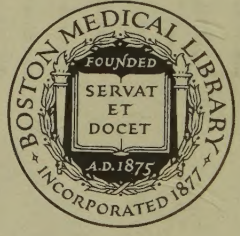

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PROCEEDINGS

OF THE

Third Race Betterment Conference

January 2-6, 1928

Under the Auspices of the

Race Betterment Foundation

Battle Creek, Michigan

Host of the Conference

The Battle Creek Sanitarium

PUBLISHED BY THE RACE BETTERMENT FOUNDATION

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The Third
Race Betterment Conference

PURPOSE

To bring together a group of leading scientists, educators and others for the purpose of discussing ways and means of applying science to human living in the same thoroughgoing way in which it is now applied to industry—in the promotion of longer life, increased efficiency and well-being and of race improvement.

—JOHN HARVEY KELLOGG
President Race Betterment Foundation.

B. B.
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Sir W. Arbuthnot Lane, President The New Health Society, London, England

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Dr. S. Adolphus Knopf, Formerly Professor of Phthisiotherapy at New York Post Graduate Medical School and Hospital

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John W. M. Bunker, Ph.D., Associate Professor of Physiology and Biochemistry, Massachusetts Institute of Technology

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WILLIAM T. ANDERSON, JR., PH.D., Research Laboratory, Hanovia Chemical and Manufacturing Co.

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DR. HORACE LOGRASSO, Superintendent J. R. Adam Memorial Hospital (Perrysburg), Department of Public Safety, City of Buffalo

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PROFESSOR M. V. O'SHEA, Head of the Department of Education, University of Wisconsin

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DR. W. A. EVANS, Professor of Hygiene, Northwestern University; "How to Keep Well" Department, Chicago Tribune

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Dr. Charles Scott Berry, Professor of Educational Psychology, University of Michigan; Director of Special Education, Detroit Public Schools

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Dr. C. E. Rugh, Professor of Education, University of California

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Dr. J. A. Stucky, Oto-Laryngologist St. Joseph's Hospital, Lexington, Ky.

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Dr. Harvey W. Wiley, Director Bureau of Foods, Sanitation and Health, Good Housekeeping Magazine

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Dr. J. H. McCurdy, Director of Physical Education, International Y.M.C.A. College; Editor "American Physical Education Review"

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JOHN SUNDWALL, PH.D., M.D., Professor of Hygiene and Public Health, University of Michigan

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FIELDING H. YOST, Professor of Physical Education, University of Michigan

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MISS MABEL LEE, Director Women's Gymnasium, University of Nebraska

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MR. EUGENE T. LIES, Special Representative of the Playground and Recreation Association of America

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SOUTH, DR. L. H.
Kentucky State Board of Health, Louisville, Kentucky

STEELE, MR. AND MRS. HAROLD
Public Schools, Saginaw, Michigan

SUMNER, MISS ALLENE
NEA Service, Cleveland, Ohio

THOMSEN, MR. ERIC H.
Ann Arbor, Michigan

TOBEY, DR. JAMES A.
American Public Health Association, New York City

TRACEY, DR. FRANK W.
American Academy of Applied Science, Blue Island, Illinois

WEAVER, MISS RUTH A., R.N.
Kalamazoo Public Schools, Kalamazoo, Michigan

WHITNEY, MR. LEON F.
Executive Secretary American Eugenics Society, Inc., New Haven, Connecticut

WILKES, DR. LEROY A.
American Child Health Association, New York City

Local Cooperating Organizations

Altrusa Club.
Alumnæ Association of the Battle Creek Sanitarium and Hospital School of Nursing.
American Association of University Women.
Battle Creek Board of Education.
Battle Creek Chamber of Commerce.
Battle Creek Club.
Battle Creek College.
Battle Creek Ministerial Association.
Battle Creek Welfare Fund.
Battle Creek Woman's Club.
Boy Scouts of America.
Business and Professional Women's Club.
Camp Fire Girls.
Charitable Union.
Circulus Club.
Daughters of the American Revolution.
Dorcas Society.
Fitter Families Contest Committee.
Girl Reserves.
Kiwanis Club.
Knife and Fork Club.
Knights of the Round Table.
Lions Club.
Morning Musical Club.
Order of Eastern Star.
Pavlov Institute.
Rotary Club.
St. Phillip's Library Association.
Sanitarium Men's Club.
Sanitarium Welfare Department.
University Club.
Women's League.
Women's Society of the Congregational Church.
Y. W. C. A.

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ADDRESS OF WELCOME

Dr. John Harvey Kellogg, President of the Race Betterment Foundation, and Medical Director of the Battle Creek Sanitarium, Host of the Conference.

Ladies and Gentlemen, Members of the Third Race Betterment Conference:

In behalf of the Race Betterment Foundation and of the Board of Managers of the Battle Creek Sanitarium, I extend to you a hearty welcome. I assure you that there is no place in the world where such a gathering as this would be more thoroughly appreciated or more warmly welcomed.

The Battle Creek Sanitarium is, and always has been, a Race Betterment enterprise, rather than a hospital. Its charter enumerates, in addition to the care of the sick, education and a variety of activities looking toward individual and racial betterment.

The Race Betterment Foundation is a trust established some twenty-five years ago having as its chief purpose the support of activities calculated to promote Race Betterment by the application to human life of the known facts of physiology and biology, as they are now thoroughly applied in agriculture and horticulture, and as chemistry, physics, mechanics and other sciences are applied in modern industry.

The first Race Betterment Conference was held here in January, 1914. It was presided over by the late Dr. Stephen Smith, the founder of the American Public Health Association, at that time in his ninety-second year and a fine example of the efficacy of biologic habits in promoting health and longevity.

A second Conference was held the following year in San Francisco, at the Panama-Pacific Exhibition. It was ably presided over by Dr. David Starr Jordan, Chancellor of Stanford University.

At the time the first Conference met, the facts about race deterioration, which are now fully established and quite generally known, had received little attention. A few years later, at the International Eugenics Conference in New York, the second speaker on the program remarked, "Of course, we all know that the human race will ultimately perish, but if we will give attention to eugenics, we may hope to postpone the catastrophy somewhat." And Major Darwin, the son of Charles Darwin, remarked, "If our present civilization survives, and I fear it will not, it will have to be the United States that saves it."

The newspapers called attention to the fact that there was a very pessimistic note in the Conference. Certainly no one offered a program having for its aim the salvaging of civilization and the creation of a superior human race. The Race Betterment Movement, of which this Conference is an outgrowth, is an effort to find such a program, in the

discovery of means whereby the degenerative influences that are dragging down the race may successfully be combated through the application of science, in order that our civilized life may be made as biologic and health-promoting as is that of the savage living under ideal conditions.

Why may we not do as much for ourselves as we have done for our domestic animals and our farm crops and garden products? We have fleeter horses, finer cows, more industrious hens, more delicious fruits, more wonderful flowers than the world has ever known before. Why not through the same means that have produced these marvelous betterments, applied by tactful and subtle methods adapted to human conditions not only stop the downward trend, but start an upward trend, which by small increments accumulating through many generations may create a new race of men as much superior to the finest representatives of the race today as our highest types are above those lowest in the scale?

The great purpose in these Race Betterment Conferences is to bring together, to unify and to stimulate, the activities that are working for eugenics and personal hygiene and a practical application of physiology and biology to human living.

The belief that such an optimistic program is possible is the *raison d'etre* of the Battle Creek Sanitarium. The greatest problem before the human race today is how to save the human race. Hence it is a special joy to welcome here this great body of scientific men. You are the leaders in scientific thought on this continent, the makers of current opinion. I am sure that the splendid program that Dr. C. C. Little, the President of the Conference, has prepared for you, and the discussions that will be elicited by the able papers that will be read, will help to solve this great problem.

May I say further that in inviting you here for this Conference, we were thinking not only of future generations but of you. We want you to find here "a house by the side of the road" where a tired brain worker may find rest and comfort, and possibly discover how to rest faster and to sleep sounder and to feel fitter to meet and solve weighty problems. We want you to feel at home, and to know that we are all at your service.

THE MEN AND WOMEN OF THE FUTURE

HONORABLE JOHN W. BAILEY, Mayor of Battle Creek, Michigan.

Mr. Chairman and Members of the Third Race Betterment Conference, Ladies and Gentlemen:

I feel honored to be here this evening, first, because of the tremendous importance of the objective of this Conference; second, because it gives me an opportunity for a brief moment to rub shoulders and to get some inspiration from the splendid and able men and women who take part in it, and last, but not least, because I have been able to partake of this splendidly served and splendid banquet. If I were not afraid of starting an argument with Dr. Kellogg, I would admit that his Protose and Minute Brew are a fairly good substitute for beefsteak and coffee!

A CITY OF HOMES, SCHOOLS AND CHURCHES

It is entirely fitting that this Conference should meet in Battle Creek for its third session. Battle Creek is the place where such a gathering should meet. Battle Creek is essentially a city of homes, a city in which nearly every man owns the home in which he resides. It is a city of churches, and schools, and also a city of sanitariums and hospitals. It is also a manufacturing city. Here we produce steam pumps sufficient to take the oil, the salt and the water from Mother Earth to supply the people of the world. Here we make printing presses that print the news of the world and spread it throughout creation. Here we make threshing machines that thresh the grain of two-thirds of the world. And we make here the food that is the breakfast for the majority of the people of this country and many in foreign countries. But with all our schools, all our churches, and all our manufacturing institutions, we never have produced but one Dr. John Harvey Kellogg. And we thank God for him.

It is to his genius and inspiration that this great Sanitarium is due. I remember when it was housed in one small dwelling. It is through his energy and his ability, and his desire to do something for the human race, that is due the growth of that little small dwelling to this splendid institution where we are now gathered and which will care for two thousand people who are sick and need attention. I predict that the growth of this great institution, from so insignificant a beginning three quarters of a century ago, will in the next three quarters of a century continue until we still have here the greatest Sanitarium and the greatest place on earth for the care of those in need of medical attention.

THE PRESENT RACE SUPERIOR MENTALLY

It is one of the tenets of my profession that the less you know about a subject the better you can talk upon it. Dr. Kellogg has mentioned that the race is deteriorating. If I could agree with him, I know this health Conference would change that entire situation, but I am not one of those who really believes that. I sometimes wonder when I hear what the good Doctor has to say on that subject if it is not something like this, that in former times men and women were outdoors with their feet on God's earth, the sun shining upon them, taking daily exercises in the open, while today millions of our best men and women are confined in offices. They are doing their work, they are developing themselves and their brain, until now we have through that process a race of men and women far superior mentally but possibly inferior physically to the men and women of old. I think it is probably the business of this Conference to devise some means whereby the men and women of the future can have the physique of the men and women of the past and the mental and brain power of the men or women of today.

I believe that situation will eventually come. As Dr. Kellogg has said, in the animal world, in the world of fruits and vegetables, great things have been done, principally I presume by the selection of the fittest. In the human kingdom we have not yet tried such selection successfully. I have in mind the story of the kings and royal families the world over. I think their failure has probably been due to the fact of inbreeding. That same thing has happened in the animal world, so that it seems to me such selection is not the only way that improvement has come about. If I were to offer any suggestion at all to these very able men and women who are devoting their time and lives to that subject, I would suggest that probably the better way would be to begin by eliminating the unfit. That is the way I think that we will improve the race.

Now, on behalf of the City of Battle Creek and as its chief executive, I want to say to you, ladies and gentlemen, who have left your work and your business and your profession to come to Battle Creek to join with our Dr. Kellogg in trying to devise some means and some method of improving and bettering the human race, that we are exceedingly glad you are here. We extend to you a sincere and warm welcome. We hope you will have a splendid time, and that your work will be entirely successful. We hope you will like Dr. Kellogg and the Battle Creek Sanitarium and the people of Battle Creek so well that you will come again in the near future and that the fourth and fifth and other meetings of this great Conference will also be held in Battle Creek. We assure you that you will always be welcome. I thank you.

PRESIDENT'S ADDRESS

SHALL WE LIVE LONGER AND SHOULD WE?

C. C. Little, D.Sc., President of the University of Michigan,
and President of the Conference

Have we, as yet, an adequate conception of what living really means?

There seems to be little doubt that man's average duration of life is being increased. The majority of statistical and other observations point in that direction. It would seem as though we were shifting the curve of age at death toward the upper limits of the curve, although as to the exact rate and correctness of the apparent shift, I am not so well qualified to speak as are many gentlemen here present.

MEANS BY WHICH THE AVERAGE AGE AT DEATH HAS BEEN INCREASED

There are many ways in which an improved technic in the prevention of illness and early death are being applied at present and seem to be accomplishing results. In the field of infant hygiene there is one of the striking opportunities to observe an increased improvement in technic, as a result of which today we are saving thousands upon thousands of children who under former conditions would have failed to survive.

In the conquest of infectious diseases, the blocking of epidemics, we are making real progress, as we are also in correcting constitutional deficiencies. Many people are born more or less defective, in one or another of their constitutional elements, and in the correction of these deficiencies we are making real advances.

We are also repairing wear and tear better than ever before. The human body and the human mind are subject to a great deal of wear and tear—although any individual presiding over a college is liable to think of some minds, at least, as being proof to all wear and tear (whether through disuse or some other phenomenon). Still, "wear and tear" is something that all of us feel, and it is interesting to find better methods for bringing us back to normalcy, physiologically and psychologically.

Then there is also that more recent member of the family of medical achievements, the process of rejuvenation, actual going backward, if you please, going back over the road you have traveled and having the opportunity to travel it again. We have heard a great deal about that in recent years. There seems to be absolutely no biological evidence

at the present time, however, for encouraging one to believe that transplantation of glands from one species of animal to another is a very successful process. I think that a good many of the effects of rejuvenation are perhaps psychologic. As to transplantations between more closely related individuals of the same species, we know enough to lead us to believe that it is an encouraging field for research, but as far as much of the rejuvenation work is concerned, there is need at present for separating the imaginary factors from the real factors and for finding out whether there really *is* a persistent effect from many of the operative technics that have been rather widely advertised.

WE HAVE NOT YET ATTAINED A NEW MAXIMUM AGE

I think that there is no question that we are progressing toward an increase in the average length of human life, but this is very different, and you all want to recognize this, from increasing the upper age limit of human life. Making the average age of human life 68 or 70 or 72, as the case may be, is very different from increasing the upper age limit to 120 or 140. To shift an average in a population is much easier than to make a new upper limit.

To increase the upper age limit of life, that is, to make a new maximum age for human beings and to make it a fairly common thing to attain that age, would mean that we would have to extend or prolong a process known as senility. All of us know what it means to grow old. We should either have to prolong that process of growing old, making it more gradual, or we should have to extend it to a higher age, that is, postpone its start. Neither of those things are very easy to do. It is along that line, perhaps, that less progress has been made than the claims of many enthusiastic individuals would lead us to believe was the case. We need to check the truth of those claims very closely.

The claims and hopes for the more or less indefinite duration of individual life based on immortality of any simple animal or plant tissue are also in need of careful analysis, because while they encourage us to believe that an indefinite duration of life may some day be possible, they are apt to blind us to the difficulties that arise when you place in the human body, as you do, cells or tissues of different sorts in close juxtaposition to one another. Their interactions and the effects of one tissue upon another complicate the situation greatly, just as do any processes of interrelation in our minds or elsewhere.

We need to remember also that in order greatly to prolong individual human life to new upper age limits, we shall have to develop and to maintain a sort of human "one-hoss shay," if you know Holmes' poem to that effect. You will remember that the "one-hoss shay" went a

hundred years to the day, and then went to pieces all at once. We shall have to develop an individual who can do likewise, or else we shall be in grave danger of simply having to work with a pendulum that is swinging always in wider arcs; that is, we shall find that as with increasing age the balance between different systems of organs becomes upset, the labor is increased to set them right.

Such upset balance is the first stage of constitutional disintegration with which we are most familiar. We rush here or there to the rescue of this or that system of organs and try to bring it back to normalcy. If it simply becomes a madder and madder race, with the adding of more years to life, first here and then there with ever increasing speed to bolster up a system of organs, it is not going to be a very effective proposition.

A PROMISING APPROACH TO THE EXTENSION OF THE UPPER AGE LIMITS

Other speakers on this program are going to point out to you the possibility of the existence of individuals or families or strains in which a tendency for a longer existence of the balanced condition, the natural balance between organ systems, is to be found; and that where you find these individuals or families with an ability to hold longer the balance between systems of organs, you have one of the best, if not the best, avenues of approach to the great extension of the upper limits of human life. If you can add to those individuals naturally endowed every good environmental assistance that you can give them, you are likely, possibly, to raise the upper limit somewhat.

If we attempt to bolster up various systems of organs that are disintegrating at different rates of speed, if we start this game of running from one to the other in an attempt to strengthen them, let us consider what is likely to be the result of this sort of patchwork physiology on the finer fabric of man's mentality? We do not want to lose account of the fact that we may be able to keep the body healthy, but unless it is done in a way that allows the mind to remain healthy at the same time, we are likely to have more trouble created by our technic than will benefit mankind. We must, therefore, from the very outset, watch what the effect on man's mentality may be of these more or less hurried efforts to bolster up one or another organ system and to get it back to normalcy. If it is found that the patient's mentality is greatly unbalanced or impaired during this procedure, we may have to modify it severely. In many cases it will be quite the opposite of that, of course, and we shall find correlation between improved balance physiologically and improved balance psychologically.

POSSIBLE DANGERS IN REJUVENATION

But let us once more go back to the question of rejuvenation and the more or less simple operation in which the ducts of the male reproductive system leading to the outside of the body are cut and tied off so that the secretions of the male gonad or sex gland are confined to the body there to be increased and stored. Let us suppose that physiologically that is beneficial. We shall need to know very carefully what the psychology of the individual is in order to determine definitely that we do not overbalance and give an excess of sex impulses and sex disturbances psychologically to those individuals. Mere increase of vigor in itself, increase of physiological vigor, is not the whole story. And we shall need to know what is involved in the sterilization of girls by the same method, especially those convicted of a sex offense. In the sterilization of those individuals simply by tying off the reproductive ducts, we shall need to be very sure that we do not increase their sex instinct and sex urge instead of decreasing it. Those matters need extremely careful study and research.

There will be some who will hold that we do not need to worry about such matters, and that the vigor of the young adult will be more or less indefinitely prolonged and perhaps even be made permanent by these various methods of building up systems of organs. It is perfectly fair, it seems to me, to debate that subject and to hold either side of the question. In doing so, however, let us at least agree to admit that permanent progress and the final solution of the problem of keeping people young are to a very high degree uncertain at the present time. We have got to keep an open mind in the matter. If we find an enthusiast in favor of, or an enthusiast against, any one or more of these technics, we must realize that we have much yet to learn. I would plead for broadness of vision and broadmindedness in approaching all of these problems, and for the realization that we shall not know anywhere near the whole truth about any of them until we have observed the effects upon a good many generations of human beings.

THE LIFE-PROLONGATION OF VARIETIES DEGENERATE IN FUNCTION

Now we come to the question, "Should we live longer?" That becomes a very interesting matter. I shall, if I may be allowed to, suppose that I am not talking to a group of human beings at the present time to whom that makes the slightest difference personally; that this is not a personal matter. I shall assume that we are discussing not whether anyone in this room should live longer, but whether in general people should live longer than they do at the present time. If not, why? And if so, why?

In the first place let us consider those saved from various diseases due to constitutional defects in infancy. If an individual is bolstered up by treatment of any kind, and so crosses the threshold of survival instead of staying on the other side of the door and being eliminated, it seems quite certain that the situation is not so sound physiologically as though that individual had from the outset possessed the natural inherited vigor to accomplish the same result without artificial assistance. I think that is perfectly clear. If you are trying to climb a mountain and you are so short-winded that you have to have a friend help you up, you are not so long-winded as you would be if you had been able to climb that mountain without assistance. If, therefore, there is an infant who has to be assisted over the threshold of survival by great medical attention and a great deal of care, it is perfectly clear that that infant is not physiologically so sound as one who does not need that medical attention and care.

From such medical attention, there will be an increasing number of individuals of decreased vigor preserved and retained. Variations in physiology that would have been eliminated by Nature a few decades ago will carefully be allowed and encouraged to survive. There will be a wider and wider range of human beings surviving than there was forty or fifty years ago, with the improved methods of infant care.

There will be many organs and systems in the body in which scientific efforts to avoid strain and stress will probably produce the same result as has taken place in the mammary glands of the human race. Artificial conditions that do not involve the nursing of babies have made possible the survival of a great number of individuals in whom the mammary system is atrophied or reduced or ineffective physiologically. That is because we have created artificial conditions that have made it possible for those individuals to survive. Under old conditions they would have been eliminated, for they could not have nursed their children, and their children would not have inherited the same type of physiology as the parent. That stem, that strain, of the family would then have come to an end.

Very clearly we are doing the same things for other systems of the various organs and tissues in the body. Disuse or diminution of the normal physiological function of any organ or tissue, and the replacement of the normal function by artificial means, lead to the survival of varieties of that organ or system that are degenerate in function and widely divergent from the normal type. That is a general truism, I think, in all biology.

ARE WE IN DANGER OF CREATING AN AUGEAN STABLE?

Now, since the degree of natural activity or inactivity of glands and organs and tissues is very largely inherited, it will follow that the progeny of those whose defects in physiological efficiency have been bolstered up will themselves be likely to repeat the same or worse conditions. If we preserve these individuals with abnormal or peculiar physiology by improved methods of infant hygiene, then the descendants of those individuals, through the force of heredity, are likely to reproduce the same or worse defects. These individuals, that is this second generation, will thus require a repetition of the same or even of more extensive corrective treatment as did their parents. In other words, we may possibly be starting a sort of biological Augean Stable, which fills up faster than we can empty it. It will be very interesting to watch, in the families derived from those who have themselves been preserved with great difficulty, whether or not an increasing number of such individuals and an increasingly intense degree of their difficulties indicate that we have started a type of autocataclysmic process that speeds up, that gets going faster in spite of all we can do to prevent it.

ECONOMIC CONSIDERATIONS

Besides the fact that the preservation of those who have with difficulty survived a weakened condition at birth will produce a weaker general average of those reaching a young adult condition, there is another factor to be considered. This is the fact that, by rejuvenation and the patching up of various systems as they show signs of deterioration or wear and tear, we shall have in any general population an increase in the number of individuals of the upper age classes. Now, between 60 or 85 or 90 years of age it is only the rare exception that shows mental vigor and ability to do creative work equal to that shown by individuals in middle age at the peak of their activity. The population will then in all probability consist of a higher proportion of relatively non-productive individuals. This is a condition of economic importance to be taken into very careful consideration at the outset.

SURVIVAL OF WEAKER INDIVIDUALS ULTIMATELY REFLECTED IN A WEAKENED GERM PLASM

In addition to both these effects, we shall have to take into account the fact that weakened germ plasm will undoubtedly result from the use of weakened individuals as parents. I have often wondered about the possibility of this law having operated with the Russian peasantry. I wish a study might be made of them to find out whether natural selection—which I imagine works on them as nearly as it does on any group of mankind within easy reach at the present time—has selected

them to a type adaptable to great nutritional deprivations, famines and dietary deficiency, whether they have built up a rather slow-running human physical engine that does a certain amount of work at a certain relatively low speed, and whether their minds also have reflected that general physiology of doing a certain amount of work at a relatively low ebb and flow of energy. If these things have happened, it would make an extremely interesting study because it would show natural selection of a type of germ plasm tending to adapt the individuals arising from it very successfully to rather stringent environmental conditions. I am inclined to think that if something of that kind had not been the case, there would have been greater evidence of unlikeness in the reactions of the peasantry of Russia to the various crises of all kinds with which that nation has come in contact. It would at all events be an interesting biological study at the present time.

ARE WE PRESERVING AND MULTIPLYING OUR DEFECTS?

Man has already gone well along the road to preserving a vast number of minor defects, both structural and physiological. We know about the increase in the number of foot abnormalities, and other troubles that were brought out by the statistics of the draft during the War. Dr. C. B. Davenport, who is here, is much more familiar with that than I am, having been at the head of much of the interpretation of those statistics. It was perfectly clear that a number of minor morphological and physiological defects have already been preserved by the technic that we are employing.

Our routine and standardized type of civilization is likely to do the same thing for mental variations as well, and I am really wondering whether a number of the interesting criminal and near-criminal cases that we find do not represent the results of a not very strict standard of mental selection in our present methods of civilization.

Our methods of giving an education to everyone who wants it, and of studying them very little while we are giving it to them, have certainly produced a large degree of variation within the individuals who graduate from elementary schools or high schools and receive the same diploma when they graduate. They are very widely different, and yet we have developed a system of mass education that tends to gloss over the differences and to turn out as far as surface indications are concerned a relatively standardized product. These tendencies will, without doubt, continue to increase for a time, and more and more individuals lacking the physical and mental virility to survive the more primitive conditions of life that formerly existed will be saved by the general attitude of our civilization.

CONDITIONS THAT HAVE PRODUCED A HARDY RACE

Mayor Bailey spoke of a very interesting point. He said he thought that the present human race was physically fitter than it had been in the past, physically stronger. I am inclined to think that while muscularly that is *not* likely to be true, it *is* doubtless true that we are the hardiest specimens of the human race that could possibly be devised; for if living in bad air and without sunlight and without proper nutrition and with no knowledge whatever of the use of clothing or the lack of it, if all the various eccentricities and idiosyncrasies that we have developed are any criterion at all, then certainly we have done wonders to survive, and we represent, if not the most beautiful physical derivatives of the human race, at least, I think, the thickest-shelled variety, the hardest-shelled—I was about to say the "hardest-boiled," and possibly that is the most charitable way to describe it—of any people yet produced. We would not be here if we were not of that sort because we certainly have defied many of the natural laws of health and we seem to be getting along in spite of it.

Those who are being brought up today in the large cities, with almost constant vibration and with an atmosphere liberally made up of discarded vapor from automobiles, are going to be even more interesting to watch for two or three generations because they are likely to be put to perhaps even a greater nervous and physiological stress than many of us have been in the past.

SHALL WE BE ABLE TO CARRY THE ECONOMIC BURDENS OF GREATER DEPENDENCY?

As the number of individuals who are not able to take entire care of themselves—who must go to the doctor for treatment and care, who must go to the dentist for frequent treatment, who must go to the oculist frequently to have their glasses fixed, who must go to the mental hygienist as many will have to go and as many now go in order to keep up with the procession of normal civilization—as the number of those people increases, we shall begin to feel more keenly the economic pinch that partial dependency causes. If we feel that, we shall feel a hundred times over the obvious economic pressure of the out-and-out public charge, the out-and-out defective, the anti-social, the non-social individual, who has to be confined and kept at public expense.

We shall have at that time pressure from various sources to develop means to prevent the production of the unfit, and to spread information as to how this can be done to all intelligent people. We are already feeling that pressure. The State of Michigan is one of the pioneer states in that respect. This fact, by the way, interested me very greatly

at the time of the tempest in a teapot that was caused by the fact that two years ago, after coming to the state, I mentioned the subject of contraception, control of birth, to a number of medical men and trained nurses in Lansing. I expected that it would be bringing coals to Newcastle, and I think it was. I was greatly surprised, therefore, when a state, which has the reputation of Michigan for forward thinking and forward looking, deemed it a news item—especially as you have, among other states, a reputation for having thought ahead of your generation, and of being more or less leaders in the field of the assumption of public responsibilities for the care of your defectives and for the prevention of unlimited birth of defective types of human individuals.

At the time when pressure for the decrease in the number of defectives becomes really great and general—and it is bound to reach that point—those institutions or groups that insist upon the greatest possible production of human individuals without reference to their quality will be clearly isolated. Eventually those groups will be forced by public opinion, or by the votes of the majority of the people, to stand the total expense of the care of the permanent defectives produced by them. In other words, when civilization as a whole recognizes the need of cutting off the supply of defectives, those groups, individuals or institutions that insist that they have a right to produce just as many defectives as they want to, without taking any care or precautions, will be allowed, I believe, to do so with the understanding that they assume full economic charge of those individuals. A short time after that is done, I think we do not need to worry because economic need will take care of the rest.

The world is rapidly being divided into two groups of people, those who are interested in improving by scientific means the general quality of future generations and those who are not so interested. There is a very clear division. You can tell, after you have talked with a person for ten or fifteen minutes, which side of that fence he or she is on; I think you will have no difficulty whatever. This is not a random example of the population here tonight, but you can try it on any group of people, and in a short time you will find them more or less identified. They are interested in building for the future of humanity, or not interested.

INTENSE INTEREST IN FUTURE GENERATIONS NEEDED TO PREVENT A CATACLYSM

It is probable that for some time, possibly for centuries, we may operate under approximately the present system of civilization. If we are to do so without producing a cataclysm, we must adopt an attitude not of mild interest but of intense concern in future generations. I

have often said that *what seems to have been the common cause of failure of every civilization that has come and gone was the selfish interest of the adult in his own problems, instead of the unselfish pledging of himself to the generations as yet unborn.*

Race Betterment by direct treatment of individuals always will and should be encouraged. It will be wise, however, to consider at all times the eventual results of methods of this individual treatment on the genetic constitution and survival value of the race as a whole. As in most cases, the wise course to follow will lie somewhere between visionary programs for improvement and super-sentimental consideration of the individual's rights and privileges.

AN ADEQUATE CONCEPTION OF THE MEANING OF LIVING

A wise appreciation of the full meaning of life will lead us to a different standard of values, and away from one concerned merely with physical survival. It is that point that I should like to emphasize in closing. If we want merely to study an increased period of existence of anyone of us, just ability to move around on the earth, that is one problem; but if we are going to consider life as meaning something bigger and broader and happier than merely animal existence on the earth, then we shall have to revise our ideas on life extension and on the duration of life. We shall have to consider mental poise, and we shall have to consider the side described as spiritual. We shall have to know more of what life means if we are to better the race in every possible way.

THE KEYNOTE OF THE THIRD RACE BETTERMENT CONFERENCE

Mere prolongation of physical residence on earth, without accompanying richness in mental and spiritual values, will not be worthy of the efforts of any group of people. We must have a wider conception of the beauty and idealism inherent in Race Betterment—ideals that involve something more than the mere breeding of healthier and handsomer human animals and that include the broader and much more difficult psychological and spiritual values.

With that conception we can all enter into our tasks realizing that if, in our own lifetime, we go two or three steps on a very long road, we shall have done our share. We can face the future with a great deal of happiness, as coworkers in a task that is tremendously inspiring and very much too big for any of us as individuals to solve in the short period that is given us. In other words, I hope that this Conference may take more or less as its keynote the willingness to work on limitless problems, rather than the desire to solve petty ones. In that general spirit of cooperation, I am sure there will be many more Conferences to follow in the years and in the generations that are to come.

HEREDITY AND LONGEVITY

Dr. C. B. Davenport, Director Eugenics Record Office of the Carnegie Institution of Washington

The span of life varies in different individuals from its beginning, at the fertilization of the egg, to a few minutes after fertilization, in some cases, and to one hundred years after, in other cases. From the moment new individuals start developing, death begins to occur. It continues to occur at a varying rate in successive ages until senility brings with it even for the strongest a final breaking down of function, and death.

The highest death rate occurs before birth, during the period of most rapid development and of the greatest absolute increments of growth. Just what the death rate is during intrauterine life we do not know precisely for man. Careful studies made on healthy, but inbred, strains of mice indicate that during the nineteen days of gestation over half of all embryos die. When father and mother belong to mice of different strains both of which are exceptionally vigorous, about one-third of the embryos die. In pigs, about thirty per cent die in utero.

In man, we have to depend on indirect evidence. It is of this order: About one per cent of births are twin births. On the other hand, a count in ovaries of the scars of recently dehisced eggs made on many young women indicates that about nine per cent of ovulations are double ovulations. That is, the double ovulation rate is nine times as great as the twin rate. A part of the discrepancy is probably due to a failure of fertilization of both eggs. But it is probable that in many more cases both eggs are fertilized, and then one of the two dies in utero. It may die at one day, at five days, a month, several months, after development has begun. It is probable that in different families from five per cent to seventy-five per cent and, in rarer cases, one hundred per cent, of the embryos die before they are born.

LETHAL FACTORS

What is the cause of these early deaths? We know very definitely in the case of certain strains of mice. Thus, if we mate two mice, both of which had as their parents one brown and one yellow mouse, then some yellow and some brown young will be born in the ratio of two yellow to one brown. Ordinary Mendelian expectation to such matings of this sort is 3 to 1. Experimental breeding proves that the missing third of the yellow mice would have been pure or "homozygous"

yellow. But when the yellow factor comes from both parents, the young mouse will generally die before it is born.

We now know a large number of cases, in various animals and plants, where a particular mutant gene carried in both parents (or sometimes only one) causes the early death of the young. Such mutant genes are called lethal factors. In man these lethal factors have been little studied. We know that particular pairs of consorts are sometimes sterile, and that if they are divorced and marry other consorts both may have vigorous offspring. It is probable that, in such cases, both of the sterile pair carried lethal genes.

Apart from the numerous miscarriages and still births that are recognized as such, there are many very early miscarriages that are not recognized as such. In addition to intrauterine deaths, but of the same type, are the cases of children who are born to die almost immediately. Such are many achrondoplastic dwarfs, brittle-boned infants, those with hare-lips, and cleft palates, those that are marasmic from birth, cases of amaurotic idiocy, of spina bifida, of haemophilia or bleeding, of hydrocephaly, microcephaly and partial anencephaly. This list of developmental anomalies of infants that are usually quickly fatal is a large one.

Now the cause of these infantile abnormalities has been by some ascribed to bad intrauterine environment. It is now quite certain, however, that most intrauterine deaths are due to defects in the chromosomes of the germ cells. They cannot be prevented by any medical or surgical interference. And if we could prevent them, it would be against the best interest of the race and human society in general to do so. Death is, indeed, Nature's race purifier, and interference with the operation of lethal factors is not desirable. Indeed, there is something to be said in supporting the view that our enormously expensive efforts to reduce the death rate and prolong life is probably work that is, on the whole—balancing good against bad—to a certain extent against the best evolution of the race.

THE INCIDENCE OF DEATH FOLLOWS DEFINITE LAWS

After the first few months following birth, the death rate undergoes a striking decline. The decline continues until puberty is approached, when it rises for a period, to decline again when middle age sets in. Then follows a long period that reaches, with ever-fading numbers, into old and extreme old age. The causes of death during this post-infantile period are very numerous and some of them appear to belong to the category of the accidental. Yet even including this category, the incidence of death follows definite laws.

The influence of heredity on length of life has been shown by the studies of Alexander Graham Bell using the genealogical records of the Hyde family. In this population the average age at death was 34 years. When both parents died at under 60 years, the average age at death of the children was 33 years; when both parents died at between 60 and 80, the average age at death of the children was 38 years—or four years above the population as a whole. When both parents were over 80 at death, the average age at death of the children was 53 years or 20 years above the mean of death in the general population of this family.

The age at death is largely a family matter. I may add that the records of the Eugenics Record Office comprise not a few cases where both parents and all children have died at under 50 years, and other cases in which both parents and all the children who reached maturity lived to be 75 years old.

These results clearly support the conclusion of Doctor Stephen Smith of New York expressed at the First Race Betterment Conference held at Battle Creek in 1914, and of which he was President. He was over 90 years old at that time. When asked how he accounted for his long life, he said it was first of all due to his having selected parents both of whom lived to be 90 years old. That is to say, Doctor Smith showed the same resistance to life-shortening factors that his parents did.

RESISTANCE TO DISEASE INHERITED

What do we know about these life-shortening or, conversely, life-lengthening factors? Not all that we ought to know, or all that we shall know in the near future. But still we have learned some things in recent years that help us to understand how resistance to disease is inherited. Thus, Irwin of Iowa State College has inoculated rats with the Danysz bacillus (which causes rodent typhoid fever) and of rats so inoculated only 15 per cent survived. He bred the survivors together, their progeny were similarly inoculated and 39 per cent survived. The selection of resistant parents had increased the survival rate to 260 per cent of the first generation rate. A similar result was obtained by Hagedoorn, who inoculated rats with staphylococcus. Again, Roberts of Illinois has inoculated chickens with the bacillus of infantile diarrhea. Only a *quarter* survived. When the survivors were bred together and their young were inoculated, *two-thirds* survived. The selection of resistant parents increases the resistance rate in the next generation.

Pearl has bred together brother and sister flies (Drosophila) and has found that from some of the matings the progeny and the remote im-

bred descendants of those matings were long-lived, that from other matings, the progeny were short-lived, and that the difference in length of life was in some cases very marked. He found, too, that when the mated brother and sister belonged to abnormal, mutant strains, the progeny were invariably relatively short-lived, as compared with the strains of the wild type. He concludes that duration of life is not a biologically separate character but that it is a function of an inherited constitution upon which longevity depends.

As for tuberculosis, Wright and Lewis were able to demonstrate in guinea pigs that certain pedigreed strains were much more resistant to the inoculated bacillus tuberculosis than others. Among humans it is well known that different races differ in resistance to tuberculosis. There is some reason for concluding that hybrids, especially mulattoes, and certain Scandinavian Lapp hybrids, are especially susceptible. Resistance to tuberculosis depends to a marked degree on constitutional factors. Resistance to this disease at adolescence carries most young persons successfully through the middle age.

With tumors, even more striking results have been obtained by Little and his pupil, Strong. They have demonstrated in mice that susceptibility to transplanted tumors is an inherited trait. Usually the cooperation of several factors is required to give such susceptibility. However, one strain of mice has been bred in which only one factor stands between susceptibility to, and immunity from, the growth of transplanted tumors.

SPECIFIC GENETIC FACTORS IN DISEASE IMMUNITY

What are the genetical factors that give immunity in any case? We are only just beginning to learn what they are, by studies that are being made on the production and presence of protective elements in the blood serum. First, we know that blood may contain antibodies that arise independent of any acquired immunity but that are genetically determined. Thus the isoagglutinins (which cause clumping of blood corpuscles and offer difficulties to blood transfusion) are distributed among members of a family in accordance with Mendel's law. It is probable, from studies of Spain and Cooke, that the formation of the antibodies that arise in specific hypersensitiveness like hay-fever is inherited. An inherited deficiency of blood "complement" has been described in the serum of a strain of guinea pigs. Hirszfelds and Brokman have demonstrated that normal diphtheria antitoxin occurs in some families where there is no evidence of exposure to diphtheria. Since the Dick test shows in the population every possible degree of immunity to scarlet fever, it seems probable that there is normal scarlet fever antitoxin whose production has a genetic basis.

We have then two sets of facts to unite. On the one hand the facts of congenital normal antibodies in the blood of some families. On the other, the facts of increased resistance of a population by elimination of the non-immune individuals. Combining these facts it seems clear that families naturally differ in the number and effectiveness of their protective elements. It is on these that disease resistance and that longevity, insofar as it is influenced by disease resistance, depend. Also, a population tends to maintain some natural immunity through the fact that, on the whole, such natural immunity has a survival value.

HEREDITARY IDIOSYNCRASIES

In the case of cancer we suspect that some of the factors that protect the individual are enzymes that are associated with youthful vigor, such as, perhaps, the secretions of the germ glands, for the cancer rate increases as youthful vigor declines.

Vascular degeneration constitutes a cause of death so common in later life that it is often said "a man is as old as his arteries." This is only half truth. We know very little about the causes of degeneration in the walls of the arteries. But we do know that explanations based on nutritive and other conditions of life are not wholly adequate. It is not difficult to find individuals who smoke and drink and still show no arterial hardening at eighty years or over. Hereditary constitution plays an important rôle here also.

Similarly, diabetes, pernicious anemia, goitre and some forms of obesity and of gigantism, which depend upon abnormal hormone production and which tend to shorten life, usually in turn rest on an hereditary idiosyncrasy of the hormone-producing organ. For, such an idiosyncrasy occurs repeatedly in certain families and not in others.

The foregoing considerations lead us to the conclusion that in considering the factors that make for longevity, we must not overlook the constitutional, genetical ones. Such are, in review: Normal internal developmental impulses to produce a sound body; the presence of normal antibodies that give immunity from infectious diseases; normal internal secretions to regulate metabolism and growth processes, including the tendency to resist tumor formation; an absence of those constitutional factors that permit decay of the arteries.

In general, longevity depends upon hereditary factors quite as truly as, and perhaps in no less degree than, on hygienic factors. Both kinds of factors are important. The best results follow when a hygienic mode of life is added to an excellent hereditary constitution.

STUDIES IN THE RELATION OF HEREDITY TO CANCER

MAUDE SLYE, Associate Professor of Pathology, University of Chicago.

Studies in the nature, the inheritability and the behavior of cancer have been carried on continuously in this laboratory for nineteen years. During this time a very large amount of data has accumulated. All conclusions are based upon numbers so large as to be beyond all possibility of coincidence, and to allow a very wide margin for any possible errors. For example, these conclusions are based upon over 66,000 necropsies, involving between 5,000 and 6,000 primary spontaneous neoplasms (each one confirmed by microscopic examination), covering now nearly every type and location of tumor known in human pathology. The stock has also yielded many cases of leukemia, both myelogenous and lymphatic, of pseudoleukemia and of lymphosarcoma.

These cancers are not caused by any experimental procedure, as are the tar cancers, the grafted cancers, and cancers arising after infesting the animals with large numbers of parasite larvae, or any other experimental method. They are spontaneous cancers, arising in the natural life of the animals, exactly as man's spontaneous cancers arise. Thus there is no chance, in the study of spontaneous tumors, of involving any unconsidered quantities not present in human cancer, as may possibly be done in all experimentally induced tumors. The relation that heredity has seemed to bear to the occurrence of all of these spontaneous tumors has been consistently identical.

Searching tests have been carried out that show conclusively that cancer is not contagious in my stocks of mice.

Every mouse is allowed to live out his full span of life and to die a natural death. The clinical course of cancer is closely followed throughout the life of the animal in every case where the tumor can be diagnosed during life. Necropsy is performed as quickly as possible after death, and all suspicious tissues are microscopically examined.

THE INHERITABILITY OF THE CANCER TENDENCY

The method of studying in the laboratory the relation of heredity to the occurrence of spontaneous cancer has been the same as that which would be followed in studying intensively the inheritability of any character whatever, and the criterion of the inheritance behavior of cancer has been identical with the most rigid criterion that could be applied in any study of heredity.

In 1865 Mendel worked out with garden peas a study of the method of heredity. Later Cuenot and others working with mice found that

the Mendelian method applied also in the inheritance of the animal characters tested. Much work has been done since in the study of various animal characters by investigators too numerous to be stated in the limited time at my disposal. Throughout the studies in this laboratory, hereditary predisposition has been shown to bear a definite relation both to the tendency to be exempt from spontaneous cancer and to the tendency to be susceptible to it. In thousands of mice bred in the laboratory, the tendency to be exempt from spontaneous cancer was transmitted as a simple dominant character along Mendelian lines.

RESULTS OF CROSS BREEDING

When a cancer-free mouse was mated with a cancerous mouse, none of the first generation offspring had cancer. The tendency to be exempt from cancer thus behaved like a simple Mendelian dominant. If, however, two of these first-generation hybrids were mated, one-fourth of their offspring were susceptible to cancer, while three-fourths were exempt from it. Thus the tendency to be susceptible to cancer behaved like a simple Mendelian recessive. If, instead of mating two first generation hybrids, each first generation hybrid was mated with a cancer-free mouse, no cancer appeared in the second generation. In this manner, that is by mating all first-generation hybrids with cancer-free mice, all cancer susceptibility has been ruled out of the entire family for many generations.

SUSCEPTIBILITY A "RECESSIVE" CHARACTER

The tendency to be susceptible to spontaneous cancer is also inheritable, but it is inheritable as a recessive character. This means that even though there has been a great deal of cancer in one side of the family, even 100 per cent, if there is no cancer in the other side of the family, all of the immediate progeny have been cancer free. If they, in their turn, have been mated with cancer-resistant individuals, cancer has been eliminated from their immediate families also.

Note, then, that by the successive mating of dominant non-cancerous mice with hybrid non-cancerous mice, cancer has been held off indefinitely, but has still been present potentially, transmitted by the hybrid carrier through generation after generation but never frankly shown as long as dominant non-cancer is mated with hybrid carriers. But when, in any generation—the 2nd, the 3rd, the nth—two hybrid non-cancerous mice have been mated, cancer has appeared in the next generation in almost Mendelian ratio where the mice have lived well into cancer age. In the studies in this laboratory, cancer has been held off for twenty-five generations by persistently mating analyzed pure-bred non-cancerous mice with hybrid carriers through successive generations.

But when eventually two of these hybrid carriers have been mated, cancer has appeared in the next generation.

It is this possibility of transmitting cancer through successive generations by the right selective mating, without cancer frankly appearing, that would explain in human statistics the seemingly erratic occurrence of cancer sometimes in a family where no previous cancer has been known. Our human statistics rarely cover, however, more than two ancestral generations, and the diagnoses in these are rarely based upon necropsy.

Out of the many hundreds of tests made in this laboratory, a few typical ones have been selected and charted here to show both the method of procedure and the kind of results obtained. Note how exactly these results follow the Mendelian expectation in heredity from the given type of cross made, and how rigid is the method of analysis by which the mice are classified in regard to their cancer tendency.

In strain 145 the parent female was 168. She was the daughter of parents neither of which had cancer. Her mother, female 499, died in old age of chronic nephritis; and her father, male 250, died of pulmonary infection. Female 168 herself died of uncertain causes but had no tumor. She had therefore been selected for this cross, as she apparently was an extracted cancer-resistant mouse.

The parent male, 274, died of carcinoma of the lung. He came of a family that showed at necropsy 100 per cent of cancer (strain 139). His mother, 158, died of carcinoma of the mammary gland that metastasized in the lungs; his father 193, with primary carcinoma of the lung. He was therefore used in this cross because he was an analyzed extracted cancerous individual.

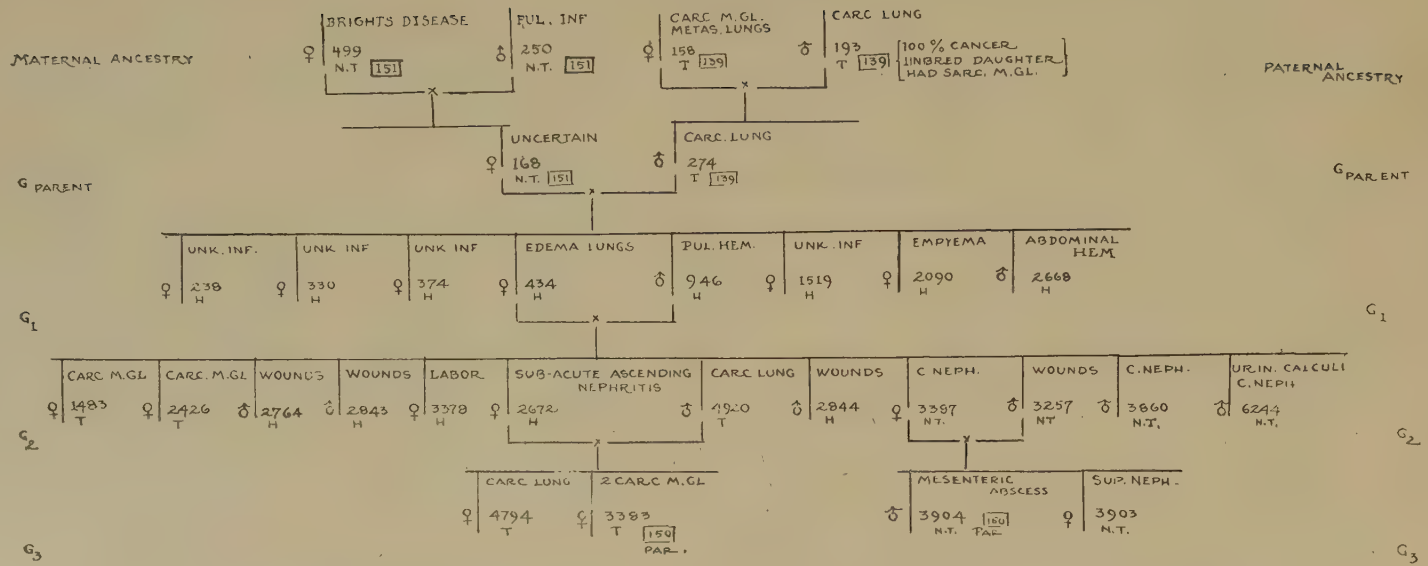
A TYPICAL MENDELIAN CROSS

We have here a typical Mendelian cross between the presence and the absence of a character; that is, male 274 with the cancer-resistant tendency absent, and female 168 with the cancer-resistant tendency present.

The first hybrid generation showed no cancer whatever. This is the typical behavior in hybridization for a Mendelian recessive. The cancer-resistant tendency thus was dominant over the cancer susceptible tendency in this cross. When two of these first generation hybrids were mated (female 434 dying of edema of the lungs without cancer, and male 946 dying of pulmonary hemorrhage without cancer), the resulting offspring showed the nearly perfect Mendelian ratio of four dominant non-cancer, to six hybrid non-cancer, to three recessive cancerous mice. The cancer representatives were females 1483 and 2426

STRAIN 145

[ORIG ♀ STRAIN 151 / ♂ " 139]



A MATING BETWEEN AN ANALYZED NON-TUMOROUS ♀ WITH A TUMOROUS ♂ GIVING PERFECT MENDELIAN RESULTS, SHOWING CANCER BEHAVING AS A SIMPLE MENDELIAN RECESSIVE.

CHART 1

with carcinoma of the mammary gland, and male 4920 with carcinoma of the lung.

AN INDIVIDUAL CAPABLE OF TRANSMITTING CANCER SUSCEPTIBILITY WITHOUT SHOWING IT HERSELF

Female 2672, in the second generation, was analyzed to determine whether she was dominant non-cancer or hybrid non-cancer, by being mated with male 4920 with cancer of the lung. Cancer appeared in her immediate offspring; female 4794 with carcinoma of the lung, and female 3383 with two primary carcinomas of the mammary gland. Female 2672 was thus shown to be a hybrid non-cancerous mouse capable of transmitting the disease though not herself frankly showing it. This mating also demonstrated the fact that when hybrid non-cancer is mated with recessive cancer, cancer appears in the immediate offspring.

In the effort to derive an analyzed pure-breeding non-cancerous mouse, two others of the offspring of the same first generation hybrid carriers were selected, female 3387 that died of chronic nephritis without cancer, and male 3257 that died of wounds without cancer. Their son, male 3904, shown in this chart, dying of a mesenteric abscess without tumor, appeared to be an extracted non-cancerous mouse. As all these mice were autopsied, as are all others dying in this laboratory, and as every suspicious tissue is microscopically examined, it is absolutely known which mice have and which mice have not any form of neoplasm.

EFFECT OF HEREDITY ON LOCATION OF TUMOR

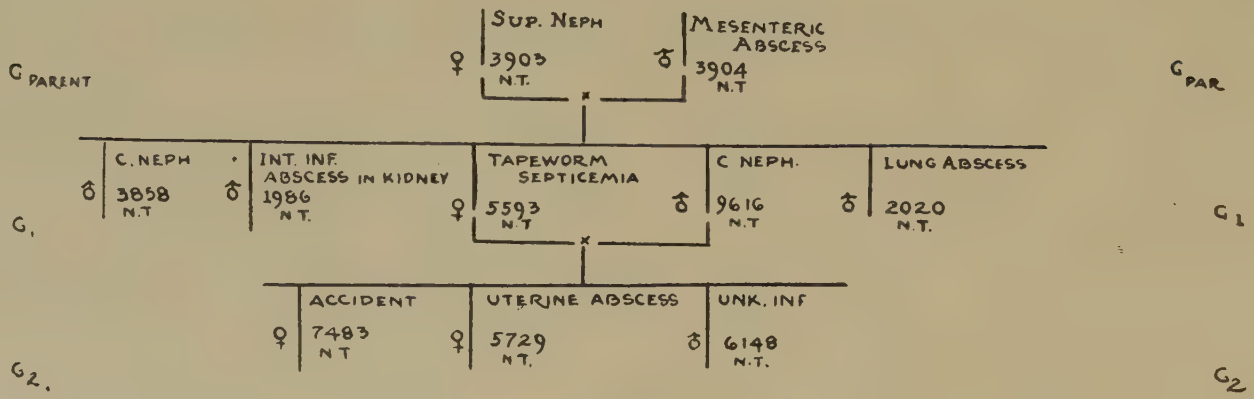
By this cross, then, there was obtained an analyzed cancerous female 3383 and an analyzed extracted non-cancerous male 3904 for further testing. Note that the types of tumors that appeared in this strain 145, and the organs in which they were located, were identical with those bred in, namely carcinoma of the mammary gland from ancestral female 158, and carcinoma of the lung from ancestral male 193 and parent male 274. No other types or locations of neoplasms occurred in this family.

Ancestral male 193 had one daughter in strain 139 (from which he was derived) with sarcoma of the mammary gland. Sarcoma of the mammary gland came out later in strain 145 as shown in chart 4, thus proving male 193 a hybrid carrier of sarcoma of the mammary gland although not frankly showing it as he died with carcinoma of the lung.

The cancer resistant tendency and the cancer susceptible tendency thus showed an inheritance behavior like a simple Mendelian dominant and recessive respectively. Also the types and locations of cancer that occurred in the offspring were the same as those bred in.

PART OF STRAIN 145

INBRED ANALYSIS OF ♂ 3904 PROVING HIM NON-TUMOROUS



NO FRATERNITY IN THIS BRANCH OF THE FAMILY EVER PRODUCED A NEOPLASM EITHER MALIGNANT OR BENIGN

CHART 2

Chart 2 shows the inbred test that was given male 3904 to prove whether or not he was an extracted non-cancerous mouse. He was mated with his sister female 3903 (also shown in chart 1). She died of suppurative nephritis without cancer, and appeared also to be a pure-bred non-cancerous mouse, as did all other mice in this branch. No fraternity of this branch of strain 145 has ever shown a neoplasm either malignant or benign, although the strain still persists in the laboratory and has been in existence over seventeen years, the original cross having been made in October, 1910. We have here analyzed pure-bred cancer resistant mice for hybridization testing.

To further test male 3904 as an extracted dominant non-cancerous mouse, he was hybridized with entirely unrelated female 711 (Chart 3) who was an analyzed non-cancerous member of strain 71 and who died in old age of an aortic rupture without tumor. No fraternity of the resulting strain 224 ever showed a tumor of any kind, although the strain persisted in the laboratory for over five years.

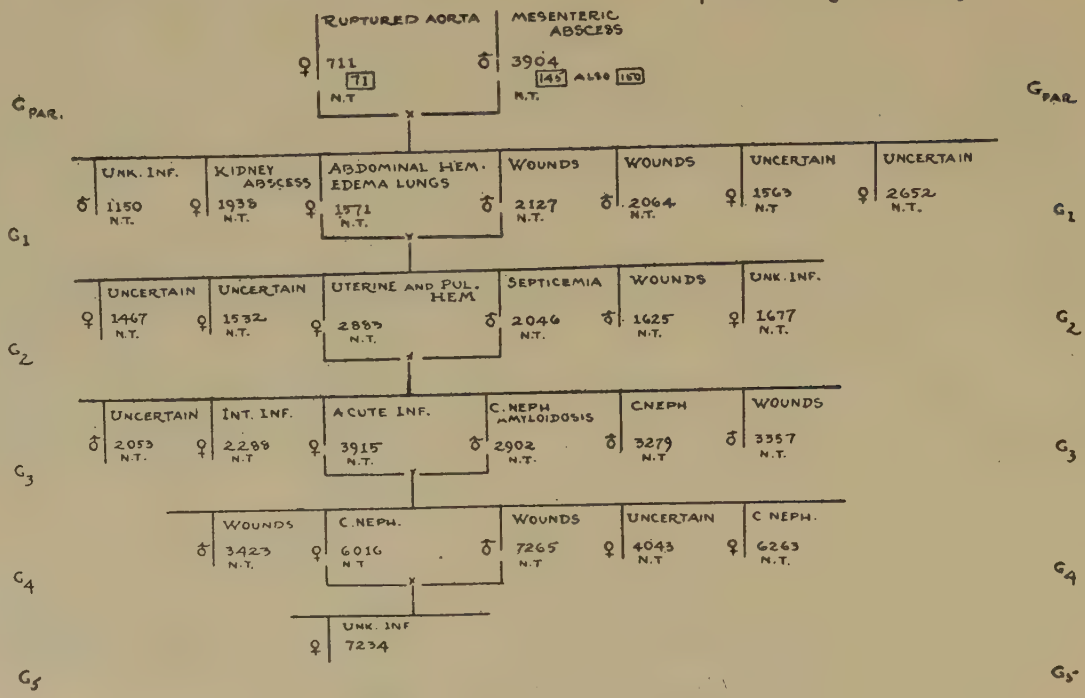
Chart 4 shows a part of strain 150, which resulted from the cross of analyzed cancerous female 3383 and analyzed cancer-resistant male 3904. The first hybrid generation from this cross was all non-cancerous; that is, again the non-cancer tendency was dominant over the cancer tendency; but cancer appeared in the second generation in female 9778 with a carcinoma of the mammary gland, and male 5695 with a sarcoma of the mammary gland. Again, when cancerous male 5695 was mated with non-cancerous female 5786, no cancer appeared in the next generation. In both tests shown in this chart, the non-cancer tendency was dominant over the cancer tendency.

This chart shows also the origins of branches I, II, III, and IV of this strain. Branch I is made by the crossing of two first generation hybrids, female 6488 and male 5426. Branch II is derived from mating two other first generation hybrids, female 10852 and male 8035. Branch III is made by mating two second generation hybrid non-cancerous mice female 12148 and male 11246. Branch IV is made by mating two second generation extracted dominant non-cancerous mice, female 10911 and male 11346. Note how in every case the inheritance behavior is in exact accord with the standard Mendelian expectation. That is, (1) the mating of a cancerous with a dominant non-cancerous mouse gives hybrid non-cancerous mice, with cancer appearing in the second generation. (2) The mating of two hybrid non-cancerous mice gives the standard three types: dominant non-cancer, hybrid non-cancer, and recessive cancer. (3) The mating of two dominant non-cancerous mice gives extracted non-cancer only, no cancer ever appearing again in such branches.

STRAIN 224

OUTBRED ANALYSIS OF ♂ 3904 PROVING HIM NON-TUMOROUS

{ X BETWEEN ♀ STRAIN 71 / ♂ " 145 }



NO FRATERNITY IN THIS FAMILY EVER PRODUCED A TUMOR MALIGNANT OR BENIGN

CHART 3

PART OF STRAIN 150

SHOWING MATING OF ANALYZED NON-TUMOROUS ♂ 3904 WITH CARCINOMATOUS ♀ 3383

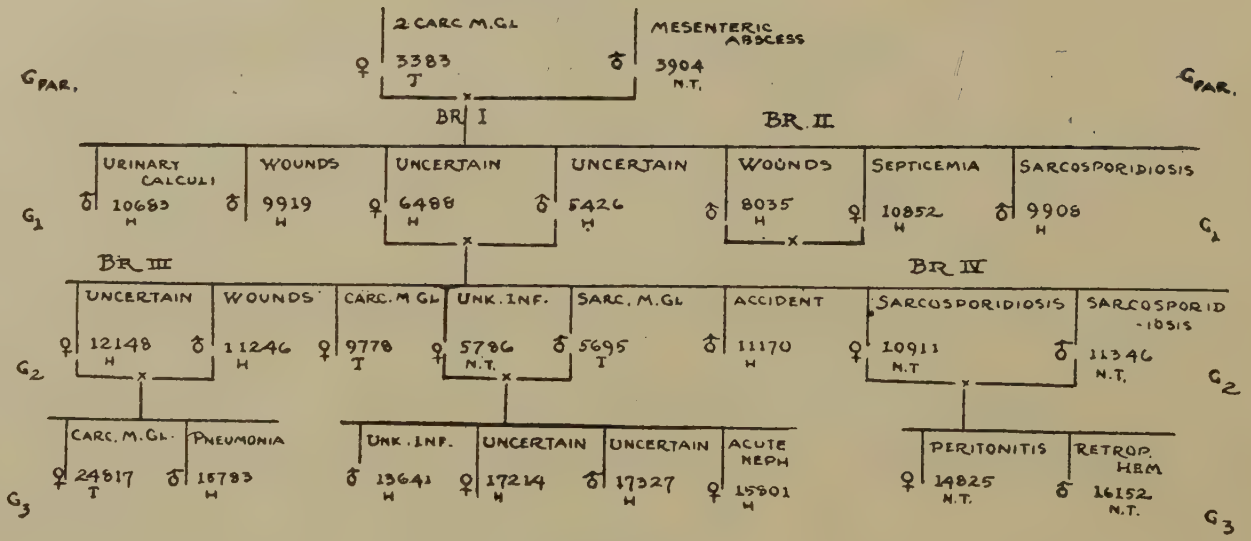
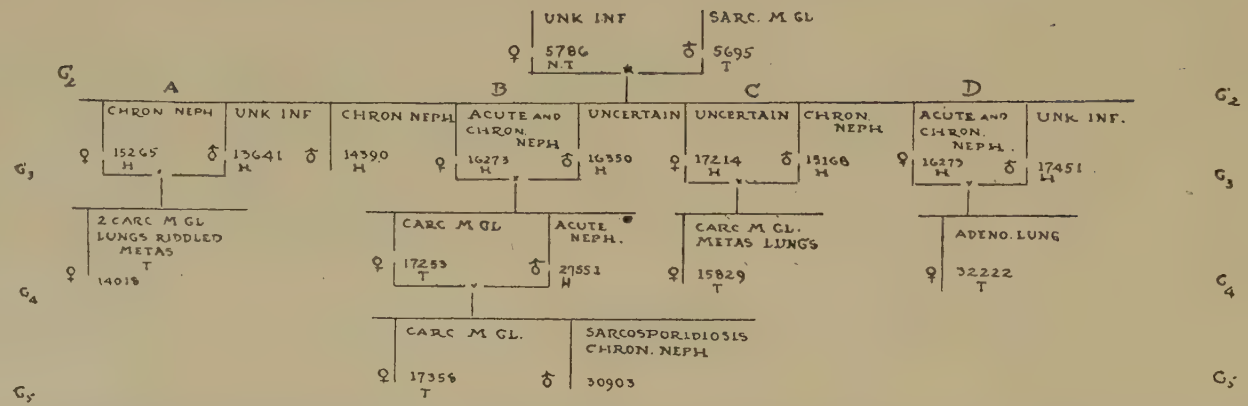


CHART 4

PART OF STRAIN 150 BR. I

CONTINUED ANALYSIS OF MATING OF CANCEROUS WITH NON-CANCEROUS MICE



A CROSS BETWEEN A NON-TUMOROUS FEMALE AND A TUMOROUS MALE SHOWING HOW CANCER APPEARED IN THE SECOND HYBRID GENERATION FROM EVERY TESTING OF FIRST GENERATION HYBRID-CARRIERS IN LINES A, B, C, AND D

CHART 5

Chart 5 gives the continuation of Branch I and shows the result of mating analyzed dominant non-cancerous female 5786 with her cancerous brother 5695 both of the second generation shown in chart 4. None of their immediate offspring ever showed tumor of any nature. Cancer thus again behaved like a simple recessive. Note that four branches of this family were made by mating four pairs of these hybrid non-cancerous mice, and in every case some cancer appeared in the next generation (generation 4 of the chart).

Throughout these charts the only tumors, both primary and secondary, that occurred were tumors of the mammary gland and of the lung, like the ancestral tumors of the strain, shown in chart 1.

Chart 6 shows part of an extracted 100 per cent cancerous strain, strain 338 Br.V., derived from double cancerous parentage, female 8619 with two carcinomas of the mammary gland, and male 8751 with an adenoma of the liver. The ancestry behind this strain has previously been published.[1] It is here omitted in order to get the chart within the necessary limits. The ancestry while in my hands carried sarcomas, carcinomas and adenomas in most of the organs here represented.

Note the large number of liver tumors, sarcomas and adenomas, there being eleven cases of liver tumor, primary and secondary, out of twenty-four individuals, or nearly 50 per cent. This is very noteworthy, because outside of this stock there have been only two spontaneous liver tumors reported in mice in all the literature, one by the Imperial Cancer Research Laboratory of England [2] and one from the cancer laboratory of Harvard.[3] The liver tumors in this strain were deliberately bred, in the effort to show that the uncommon internal tumors, as well as the more common mammary gland tumors, unquestionably were determined by heredity.

In Line A note female 8865 with an osteoid sarcoma of the mammary gland metastasizing in the liver, succeeded by her grandson male 16370 with an osteoid sarcoma of the subcutaneous tissues of the leg, metastasizing in the liver. Note the very frequent occurrence in this strain of multiple tumors, particularly females 9741, 12261, 22263, 30469 and 30501. The latter two mice had more neoplastic than normal tissue at their death.

1. Slye: Jour. Can. Res., Vol. I, No. 4, 1915.
2. Murray: Third Scientific Report of the Imperial Cancer Research Fund, 1908, 69.
3. Tyzzer: Jour. Med. Res. 1909, XXI, 479.

PART OF STRAIN 338 BR. V

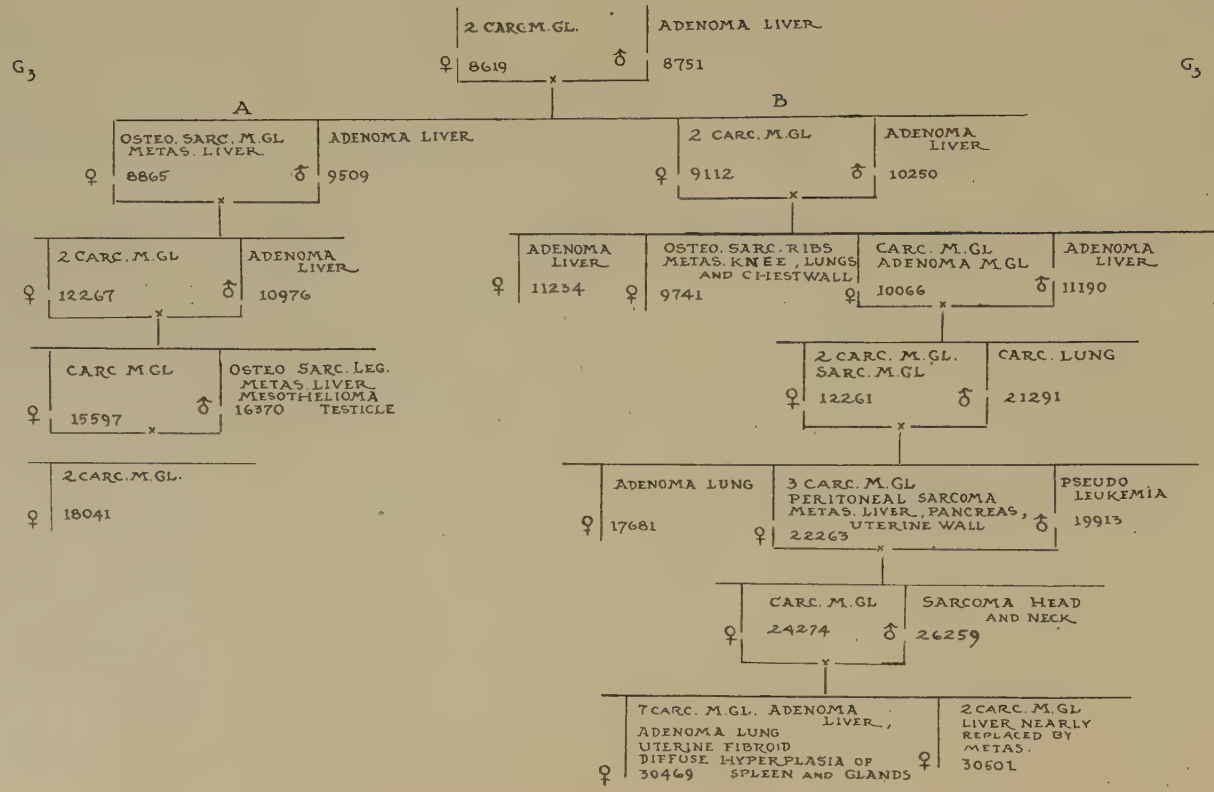


CHART 6

OTHER DISEASES THAT APPARENTLY FOLLOW THE SAME LAWS OF HEREDITY

In this strain there is one case of pseudoleukemia, a disease that occurred also in the ancestry of this strain. In this laboratory chronic leukemia, pseudoleukemia, lymphosarcoma and kindred diseases have uniformly occurred in cancer strains only, and have followed the laws of heredity as surely as have neoplastic diseases. Their behavior in this laboratory would indicate that they are neoplastic diseases. A report on the relation of heredity to these diseases will be made as soon as the data have been analyzed completely.

These charts are typical. Whenever in this laboratory two cancerous mice have been mated, it has been possible to secure 100 per cent cancer families except for those mice that have died in infancy or that have been swept off by infections earlier in life than the normal age for the cancer to which they were predisposed. Occasionally a mouse in one of these 100 per cent cancer strains, derived from double cancerous parentage, has developed a cancer when only two weeks old, although six months is an early cancer age in mice and is approximately the equivalent of 32 years, an early cancer age in man.

THE PERFECT MENDELIAN PATTERN SHOWN IN A HYBRIDIZATION TEST

In the hybridization test also, susceptibility to cancer and resistance to cancer have proved uniformly to be inheritable. These two tendencies have followed almost with exactness the inheritance behavior of a simple Mendelian recessive and dominant respectively. It is this hybridization test that proves beyond dispute the inheritability of any character, for nothing but heredity could explain the segregating out and the transmission unchanged of characters in which the two parents are unlike, and the perfect Mendelian pattern that they follow—as for example, albinism and pigmentation, or cancer susceptibility and cancer resistance. Where both parents die of the same disease and all the later members of the family die from the same cause, as in a 100 per cent inbred test, we have no sure demonstration that it might not be a case of epidemic contagion, either extra- or intra-uterine. But we cannot explain by contagion the perfect Mendelian pattern shown in a hybridization test. This pattern, by every test that I have been able to make with spontaneous cancer, the cancer susceptible and the cancer resistant tendencies in mice of my stocks have followed uniformly.

A STRAIN THAT SHOWED THYROID MALIGNANCY ONLY

The next two charts show some of the most recent work in the relation of heredity to cancer resistance and cancer susceptibility published from this laboratory. They are concerned with a strain of Japanese waltzing mice in my hands for twenty-eight generations, which

have shown thyroid malignancy and no other type of tumor. In a little family of 133 members bred for thyroid malignancy, there have been eleven of these cancers or 8.2 per cent of all deaths at all ages.

Chart 7 shows generations 15 to 21 inclusive. In this part of the family comprising 24 members, there occurred four of these tumors. With the exception of generation 17, the occurrence of thyroid cancer shown in this chart is in classic form. In this 17th generation, where

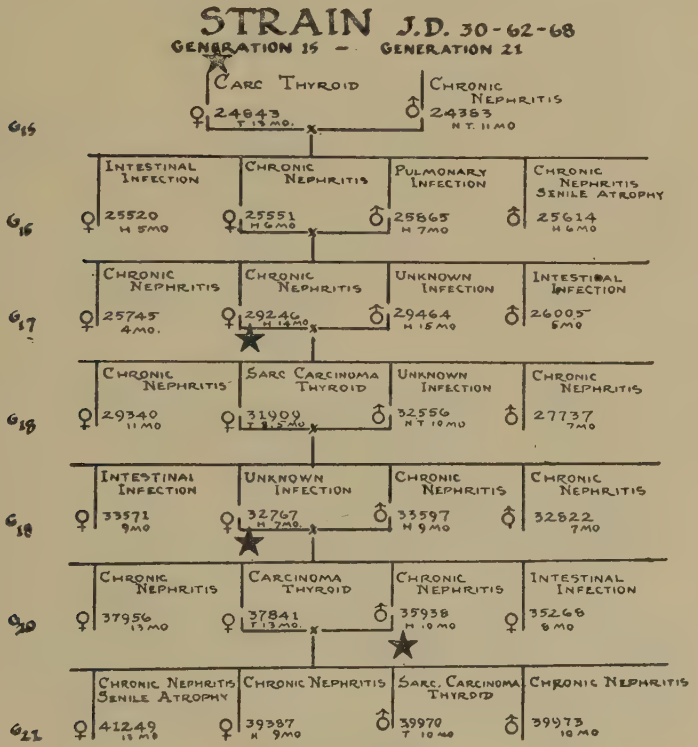


CHART 7

an occurrence of cancer might have been expected, nearly all the members died under five months, so that the cancer potentiality of this generation was not perfectly tested, as thyroid cancer has not appeared under six months of age in any stock in this laboratory. In generation 18, the mating of cancerous female 31909 with cancer resistant male 32556 produced only hybrid carriers, and no instance of malignancy. From the mating of two of these hybrid carriers in generation 19, thyroid cancer occurred in the 20th generation. Again, by the mating of cancerous female 37841 with hybrid carrier male 35938, both of the 20th generation, thyroid cancer occurred in the 21st generation, male 39970.

STRAIN J.D. 30 - 62 - 68

GENERATION 21 - GENERATION 28

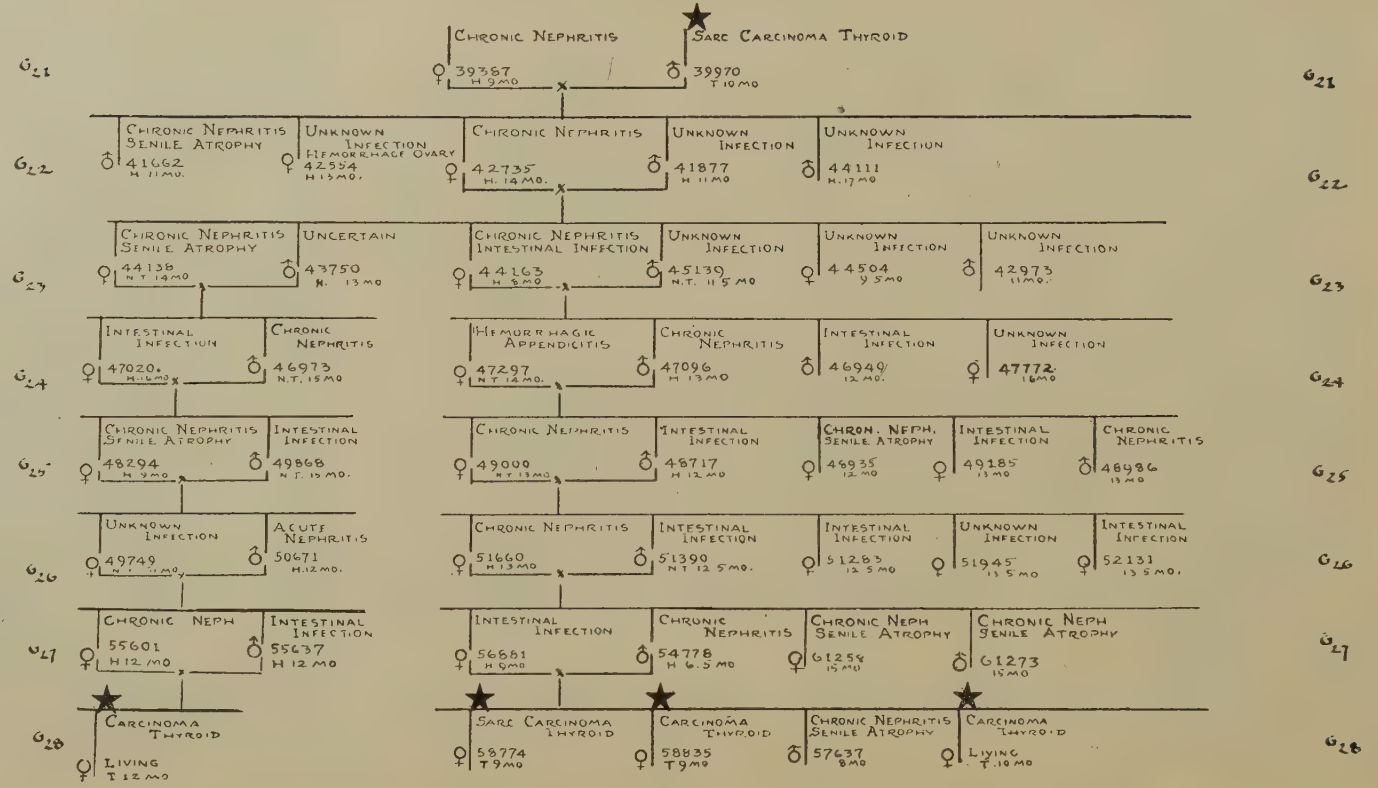


CHART 8

Chart 8 shows male 39970 (21st generation) with a sarcoma-carcinoma of the thyroid mated with hybrid carrier female 39387, dying at nine months with chronic nephritis without cancer. By selective mating in each successive generation (after the 22nd) of analyzed resistant individuals with what seemed to be hybrid carriers of susceptibility, all occurrence of cancer was held off for six generations in each branch of the family, that is from the 22nd to the 27th generation inclusive. In this 27th generation, when two of these hybrid carriers were mated, thyroid malignancy occurred in the next generation in each branch of the family in almost perfect Mendelian ratio. The other eight young in the 28th generation, offspring of female 56881 and male 54778, are omitted for lack of space. No one of them has developed cancer. Some of these mice are still living, and the final ratio cannot be established until after necropsy of the entire generation. No other member of the other branch of the 28th generation shown in the chart has as yet developed cancer.

The complete study of thyroid tumors in this stock will be found in the 25th report of this work.[4]

THE INFLUENCE OF HEREDITY IN DETERMINING SECONDARY NEOPLASMS

Not only has heredity definitely controlled the occurrence of primary tumors, but it has also controlled the occurrence of secondary tumors.[5] The tests made in this laboratory have shown that the only secondary tumors that occur in any strain correspond with the primary tumors within that strain, both in type and in the organs in which they occur. Thus showing that only those organs that are susceptible to primary tumors in any individual or strain are susceptible to secondary growths. These tests have demonstrated also that secondary tumors are as potent in heredity as are primary tumors, in determining the type and the location of primary neoplasms in mice. That is, for example, the tendency to primary sarcoma of the kidney has followed from an ancestor with secondary sarcoma of the kidney and vice versa. Note chart 9.

The parents in strains 48 and 292 are female 3 and male 360. Female 3 had a sarcoma-carcinoma of the mammary gland, a malignant adenoma of the liver, and sarcoma metastases in the kidney. She came of a family (strain 90) that carried also tumors of the mesenteric glands, ovary, spleen, adrenal and lungs, as well as leukemia and pseudoleukemia. She proved to be a hybrid carrier of these tumor locations, and transmitted the tendency to tumors in all of these organs to some of her posterity, in hybrid crosses with analyzed non-cancerous males. Parent male 360 was the son of male 436 that died of carci-

4. Slye: Jour. Can. Res. Vol. XI. No. 1. March, 1927.
5. Slye: Jour. Can. Res. Vol. VI, No. 3, 1921.

PARTS OF STRAINS 48 AND 292

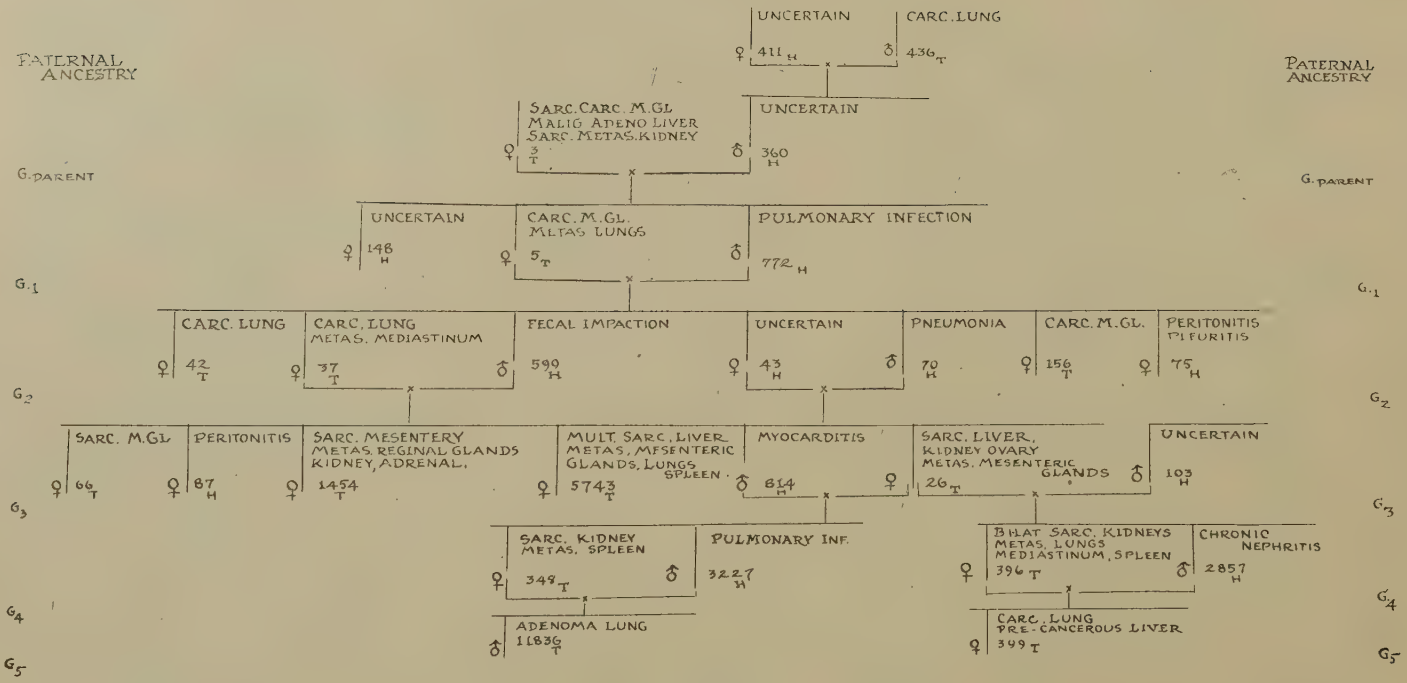


CHART 9

noma of the lung. This strain also carried mediastinal tumors primary and secondary. Male 360 was thus a first generation hybrid carrier of cancer, although not frankly showing it.

We have here then the mating of a cancerous female with a hybrid-carrier male. The first hybrid generation from this cross showed some tumorous individuals and some hybrid carriers in about equal numbers. Note that both the primary and the secondary tumors are of the same types and occur in the same organs as those bred in. These strains 48 and 292 were selected for presentation here because they show locations of neoplasms in mice that have not been reported at all or else rarely reported from other laboratories. This chart shows that these internal tumors, difficult to diagnose clinically, follow exactly the same laws of heredity as do the easily noted mammary gland and skin tumors.

It is very difficult and laborious to secure these strains yielding high percentages of internal tumors, because it is so difficult to diagnose them before the death of the mouse, and in time to secure offspring from such a selected parentage. Only by long continued and painstaking effort is it possible to secure them; but when we find five sarcomas of the kidney, four sarcomas of the liver, three sarcomas of the mesentery, one sarcoma of the adrenal, three sarcomas of the spleen, and one sarcoma of the ovary, in addition to numerous carcinomas of the mammary gland and of the lungs, in a little family of sixteen members whose ancestry was known to carry all these locations and types of tumors, the certainty of hereditary control is evident. It has been suggested that mammary gland cancer, being the most commonly reported tumor in mice, might occur in these large numbers by chance, but it is not possible to think that such rarely reported internal tumors as those shown in this, and in others of these typical charts, could have occurred in such large numbers, and in 100 per cent of the family, by chance.

Many strains in this laboratory have been so manipulated [6] in selective breeding as to exclude primary tumors of the lungs, common tumors in mice. The lung is also one of the most frequently reported seats of secondary growths in mice. In such strains in my stocks, where primary lung tumors never occur, no tumor metastases grow in the lungs even where tumor emboli are very numerous in the lung blood vessels. Also in strains that do not carry liver tumors in my stocks, no secondary growths have appeared in the liver, even when multiple emboli have been present throughout the liver vessels, whereas in those strains where primary tumors occur in the liver, the liver is a frequent site for secondary growths, as shown in strain 338 Br.V and in strains 48 and 292.

6. Slye: Jour. Can. Res. Vol. VI, No. 2, 1921.

FIFTY GENERATIONS EXEMPT FROM CANCER

The fact that the tendency to exemption from cancer is inheritable should be re-emphasized. Many hundreds of strains and branch strains have been carried in this laboratory that have never shown a tumor growth of any kind either malignant or benign. This means that in many families carried for fifty or more generations and comprising many thousands of members, there has been complete exemption from cancer. These cancer-free mice, when bred into other families, carry with them exemption from cancer as a dominant character. Compare this with the record of man who pays no attention to heredity in his matings, and where one in eight over a given age is dying of cancer, and note how tremendously hopeful is this fact of the inheritability of the tendency to be exempt from cancer.

CAN CANCER BE AVOIDED IN SUSCEPTIBLE INDIVIDUALS?

There are apparently two factors necessary to induce cancer. If either of them could wholly be avoided, it might be possible to prevent cancer. These factors are (1) an inherited local susceptibility to the disease, and (2) irritation of the appropriate kind and in the appropriate degree applied to the cancer susceptible tissues. Experiments eliminating one or the other of these two factors, in order to see if cancer can be avoided in this way, are being carried on in this laboratory with a promise of some success. In these experiments, by avoiding either the cancer susceptible factor or the irritation factor, cancer has in some cases been avoided. The experiments thus suggest that both inherited susceptibility and local irritation were necessary in inducing cancer. They suggest that cancer susceptibility is local and not systemic. In mice susceptible to only one location of cancer, no amount of irritation or stimulation applied to other parts of the body has ever to date induced a cancer. Avoidance of irritation to the locally susceptible tissues has in some cases prevented cancer, even in susceptible individuals. This would suggest that if an individual susceptible to cancer would protect himself against irritation of locally susceptible tissues, he might avoid cancer even though he is a member of a family with much cancer.

The fact of the inheritability of exemption from cancer is one of the few hopeful observations ever made concerning this disease, because it means that at least among mice, instead of every one being susceptible, large numbers are wholly exempt. It also means that it is possible in mice wholly to eliminate cancer from any family by the right genetic procedure, as I have eliminated it from hundreds of families involving thousands of individuals.

PARALLEL HEREDITY OF LOWER MAMMALS AND OF MAN

What I have said regarding the certainty of the relation of heredity to exemption from spontaneous cancer and to the tendency to be susceptible to spontaneous cancer has to do with the mice of my stocks. Its application to man and to most other animals remains to be tried. But mice are mammals like man. Organ for organ their anatomy and functions are markedly similar in all fundamentals that we can test. We find marked similarity in such types of tissue behavior, both normal and abnormal, as we are able to test in both man and the lower mammals. Tissue reactions in reproduction, regeneration and all the fundamental vital processes are markedly similar. The differences in refinements and complexities attach themselves only to the less basic entities. Heredity is the most fundamental of all basic biologic facts (next to the fact of the existence of life itself) and it plays the leading rôle in evolution. The methods and facts of heredity in the lower mammals must be the methods and facts of heredity in man, unless there is a break in the evolutionary line between man and all other forms of life.

Moreover, the spontaneous cancers under study in this laboratory are similar to those of man in all essentials of structure and of behavior of which we are informed. Heredity applies in man and it applies in mice. Man has neoplasms and mice have similar neoplasms. The suggestion that the relation between heredity and cancer may be similar in both surely offers itself, unless we discard evolution as the explanation of organic life as it exists today. For if evolution means anything, it must mean that down the full line from the single cell to man, similar tissues derived from ancestral tissues have responded in the same way as the ancestral tissues to the same types of stimulation. Only so could an unbroken series of organisms evolve each from the preceding. The methods and facts of heredity in man would therefore seem to be the methods and facts of heredity in other mammals.

Therefore, since it is possible wholly to eliminate spontaneous cancer from families of mice by the appropriate genetic procedure, it might prove to be possible so to eliminate cancer from families of man. This does not mean that we can relax our vigilance against any forms of chronic irritations in any case, since we have not as yet even begun to apply the facts of heredity to the human species and we have few adequate statistics of human heredity in regard to disease. But it does mean that we should begin to get correct scientific statistics regarding diseases in man, based upon biopsy or necropsy in every case, and not upon opinion, so that we may make such an application, because in this procedure lies much hope.

THE EDUCATION OF THE GENETIC SENSE THE GREAT HOPE OF HUMANITY

Moreover since there is in man the beginning of a genetic sense (that is, a sense for the fitness of matings), it should be possible to educate this genetic sense. *This is the great hope for humanity.* The way to educate it is to make generally known the facts and operation of heredity, so that man need not be blind as to what characters he is transmitting to his posterity. If, moreover, we would uniformly permit examination after death, as is the invariable rule in the laboratory, the exact facts concerning diseases in man could better be obtained. If these facts were then kept in permanent record, as every fact and every cancer tissue is kept in permanent record in the laboratory, in two generations by the right selective matings it might prove to be possible to begin to eliminate cancer, as I have completely eliminated it from hundreds of families of mice in the laboratory.

The findings in regard to the rôle of heredity in the causation of exemption from cancer and of susceptibility to cancer in mice are, therefore, worthy of consideration and of trial for man. And the trial can be in no way either detrimental or painful, as a new therapy may be; for, if these findings should upon trial prove to hold for man, the way of the elimination of cancer is open.

THE GENETIC BASIS OF EUGENICS

Dr. E. M. East, Professor of Genetics, Harvard University.

It would be difficult for an intelligent person to find objectionable features in eugenics if eugenists confined themselves to the definite ends proposed by Galton in 1883, namely, "The study of the agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally." Even G. K. Chesterton would then be hard put to it to find material for a very long essay on the evils of the subject.

But a truly Pythagorean doctrine, with study a joy in itself, appeals to few minds. Most people want action. Sir Francis himself was at one with the majority in this respect. In explaining at greater length the objects of eugenics, he says: "Man . . . . has the power of preventing many kinds of suffering. I conceive it to fall well within his province to replace natural selection by other processes that are more merciful and not less effective. This is precisely the aim of eugenics. Its first object is to check the birth rate of the unfit instead of allowing them to come into being, though doomed in large numbers to perish prematurely. The second object is the improvement of the race by furthering the productivity of the fit, by early marriages and the healthful rearing of their children."

Here is where the trouble begins. Doubts arise. Is a given eugenic procedure based upon sound principles? Is it desirable? Is it expedient? And such hesitancy is right and proper. The duty of doubt, as Haldane calls it, is an especially serious obligation in applied science. An error in a general biological theory or in a hypothetical mathematical equation is of no great importance. The principle of natural selection, which is at work in the intellectual as well as in the physical world, ultimately will destroy them. A mistaken conclusion in genetics applied to human affairs, or an erroneous calculation in planning a great bridge, may have grave consequences.

For these reasons, it is unnecessary to apologize for undertaking to examine the genetic basis of eugenics. The sociologist should be assured of a solid foundation for a usable superstructure if he is to spend his time as constructive engineer on this particular job.

We ought to approach the examination impartially and objectively, unswayed by the bogies and banshees that the folkways of our people materialize in our minds. I mention this point because eugenic discussions, dealing as they do with some of the ancient customs that hedge the inmost urges of man, are prone to call forth violent emotional reac-

tions. This is not a proper occasion to deal with the psychology of emotions; yet I do not think it out of place to call attention to the fact that subjective reactions—which are reactions tied up with the unorganized collections of fact and legend with which our minds are filled —undoubtedly color all our thinking in some degree. This is especially likely to be the case in all questions where homology or relationship between man and other organisms is implied.

HEREDITY AND ENVIRONMENT "COLLABORATING ARTISTS"

The work in genetics during the past quarter of a century has been so productive that an eminent biologist has expressed the conviction that the mechanical problem of heredity has been solved, and there is hardly a doubt but that he views the matter correctly.

The inheritance received by a fertilized egg is a double set of heredity units, the genes, one being received from each of the parents. These sets of genes develop into a mature organism provided the fertilized egg meets a hospitable environment. There is no question, then, as to whether heredity or environment is more powerful. Both are essential. They are collaborating artists; their finished product is the individual. But the rôles of these two moulders of destiny are different. The genetic constitution received at fertilization definitely delimits the end result. One does not gather figs from thistles. Nevertheless, environments can differ materially without preventing development; and these environmental extremes may have a considerable effect on the final product. A fertilized egg is somewhat like an exposed photographic plate. The potentiality of a picture is there, waiting to be developed. The environment is the developer. It can make or mar the picture, but that picture will have the same general character in any event.

How does one come to such a conclusion? Thus! Hundreds of experiments have been made in which the genetic constitution has been held constant, while the environment has been varied. Hundreds of other experiments have been made in which the genetic constitution has been varied, while the environment has been held constant. This experience has led the geneticist to see that while a hospitable environment is absolutely essential if one is to get an adult from an egg, the variation that different environmental extremes can induce is small. Suppose we have in our hands two roses, one yellow and one red. What these roses were to be was foreshadowed when the pollen grains entered the ovaries. One may keep these seeds where they cannot fulfill their destiny in producing plants, but if the seeds are planted where the plants can come to maturity, then the resulting flowers will tend to be yellow in the one case and red in the other. The greatest

change within the power of the gardener is to make such flowers a little darker or a little lighter yellow or a little darker or a little lighter red by diverse horticultural treatments. Translating these deductions into terms of sociology, one may say: Give the developing child the best conditions possible—it is highly desirable—but do not expect to change Nature in any high degree.

THE MECHANISM OF HEREDITY

The mechanism by which the genes are distributed to the new generation, which is what we call heredity, has been subjected to intensive study during the past few years. The result has been to establish the chromosome theory of inheritance. The chromosomes are small bodies found in the nucleus of each of the body cells. Within them are the unit factors of heredity, the genes. The chromosomes are definite in number, size, and shape in each species. Every one of the ordinary cells of the body may contain, let us say, twelve of these gene carriers. Six of them come from the father and six from the mother. When the germ cells are formed, this number is reduced by half. Each mature germ cell receives one chromosome of each set, and it is a matter of pure chance whether a given germ cell receives a particular chromosome from the father-member or the mother-member of the pair to which it belongs. This process, the mode in which the genes are distributed to the germ cells, is the basic tenet of genetics, the principle from which flow the laws of heredity, and crossing experiments by the thousands have borne witness that our ideas regarding it are sound.

It may be desirable to pause at this point and ask: What evidence exists to show that inheritance in man is of the same type as that exhibited by the lower organisms? There are two reasons for feeling that *Homo sapiens* is not an exception to the established order. Studies with the microscope have shown that the manner in which fertilization occurs is practically identical in the various orders of flowering plants, in mollusks, in insects, in fishes, in amphibians, in birds, and in a whole range of mammalian families. Now man is simply a higher mammal. His anatomy and physiology are very similar to the anatomy and physiology of other mammals high in the evolutionary series. From this fact, one might reason that the method by which his heritage is passed on would also be similar to that of other organisms. But no such abstract conclusion is necessary. Actual observation has shown that the body cells of our species contain 48 chromosomes, and that these chromosomes undergo the special type of reduction division characteristic of other sexually reproducing species, leaving 24 chromosomes in each of the germ cells. Man, therefore, has the chromosome

mechanism for the distribution of genes that is common to all the higher animals and plants.

In addition, genealogical records have shown that certain simple character differences, like brown eyes and blue eyes, or normal mentality and feeble mindedness, are inherited as one would expect them to be inherited if these contrasting states were due to difference in single genes carried in the chromosomes. Sex is even fixed by the possession of a particular kind of chromosome. And it has been proved that hemophilia and color blindness are due to genes carried in this same chromosome, just as sex-linked characters in other organisms are due to genes carried in the so-called X-chromosomes which have perhaps the most direct control over sex. Other more complex characters show no exceptions to this generalized scheme. The details of gene interaction are more difficult to determine in such cases; yet it is significant that where complex character differences are under consideration, the genealogical records and the records from the genetic laboratory are similar in character. Mathematical analysis of the controlled experiments brings out certain conditions that ought to be satisfied in the genealogical records if the heredity mechanisms are comparable in the two cases, and these conditions are satisfied. Geneticists are all convinced, therefore, that inheritance in man is the same as in maize, mosquitos, melons, or monkeys.

THE INHERITANCE OF MENTAL ABILITY

Numerous critics, who accept this genetic generalization for physical characteristics, question whether it holds for mental characteristics. It is not, I believe, that they deny a physical basis for mentality. They merely hold that although the anatomical features of the human race exhibit radical differences, the central nervous system is relatively constant. The assumption has no factual basis; and is, *a priori,* illogical. It is apparently a subjective reaction. Those who hold this point of view sometimes try, however, to justify it by calling attention to the tremendous range in intellectual attainments shown by different individuals. Such extensive differences are not paralleled to anatomy, it is maintained, and therefore they must be due to the extraordinary influence of environment in developing mentality. For this reason, one may assume identical innate abilities among the members of a population and expect to find the differences in attainment, ordinarily observed, simply because of the enormous variability in opportunity.

There are three lines of evidence upon these points—statistical studies of eminent men and their relatives, studies of identical twins, and studies of intelligence by means of psychological tests.

Among the extensive studies of eminent men and their relatives are those of Galton, De Candolle, Ellis, Cattell, and Woods. Naturally, such studies are full of pitfalls. It is difficult to select a series of names for study in a wholly objective manner. It is impossible to make accurate allowances for differences in opportunity. Eminence is not a precise measure of intelligence. Yet, in spite of their deficiencies, these studies have yielded some very significant results. The investigators all find that the relatives of great men have a very much greater chance of becoming eminent than people selected at random from the general population. The difference is too great to be accounted for by any assumed difference in opportunity. *It must also be noted that the chance of becoming great varies directly with the closeness of genetic relationship.* One must agree with Cattell, of course, that environment has an absolute veto on mental development, but one can hardly avoid the conclusion that environment is merely harnessing the forces of heredity.

Such investigations go far toward establishing Galton's most important generalization, that no man is likely to attain eminence unless he possesses innate ability of a high order. They also support—though, as Ward maintained, they do not establish—the conclusion that "few who possess these very high abilities can fail in achieving eminence." In other words, it is hard to keep a good man down.

The evidence from identical twins points in the same direction. Identical twins come from a single fertilized egg. Each member of the pair has the same heredity. And such twins exhibit mental attributes as well as physical characteristics that are much more nearly alike than are the traits exhibited by other children of the same family. They even show this same similarity when they are separated at an early age and reared under different conditions, though only a few such critical cases are known.

The intelligence tests add to this evidence. Intelligence tests measure acquirements, it is true, and they have been criticized severely on this score. But the critics should realize that there is no more reason why properly safeguarded measures of intellectual acquirements should not be interpreted in terms of genes than that developed physical character should not thus be interpreted. Two ten-year-old children, for example, show significant differences in their intelligence quotients. They are given the same studies and are tested again at the end of four years. They are now further apart mentally than they were in the earlier test. The more intelligent has advanced further than the less intelligent. What conclusion can be drawn other than that they differed in genetic constitution?

It is from such investigations that geneticists have concluded that mentality is a complex trait inherited like any other complex character. Numerous genes presumably have varied into what one may call plus and minus types. And it takes only 20 differences in such factors, inherited independently, to give the possibility of 1,000,000 different recombinations. "If the Thinker requires 20 plus genes and the Simpleton 20 minus genes, then the Average Man may be supposed to have about 10 plus and 10 minus genes. If a family stock, by selective matings, gathers together a preponderant proportion of plus genes, its average worth will rise; conversely, if a family puts its efforts into accumulating minus genes, its social value will drop. But even the mediocrities may produce Thinkers—of Simpletons—if the contributions of the fusing germ cells are such as to bring together the required genetic complex. Thus there is no difficulty in accounting for emergent individuals like Carlyle and Abraham Lincoln in otherwise undistinguished families. The proportion of eminent persons in such families will be low because of great differences in quality among the parental germ cells. On a percentage basis, selected high-grade families will often produce 10, 20, even 50 times as many notables as mediocre families. Yet the absolute number of geniuses appearing in families of the latter type will always be high because mediocrity is plentiful."

A PRACTICAL METHOD OF APPLYING PRESENT KNOWLEDGE

We may accept without reservation the laws of genetics as being applicable to man. But is it practicable to utilize this knowledge in racial improvement? On this point I am neither an optimist nor a pessimist. I am sympathetically hopeful. We must, of course, continue to investigate the inheritance of human traits. Our generalized knowledge that various characteristics are inherited, and that their distribution follows the distribution of the chromosomes, is not enough. We must know more about the behavior of the genes in specific cases. We have to ask in each definite instance whether an abnormal trait is dominant or recessive to the normal, whether it is sex-linked, or whether it is due to more than one gene. We must know whether different genetic mutations can bring about the same visible result. In complex traits, we must find out how the genes interact. Moreover, if we are to deal with mental differences, we must ascertain how to determine them precisely. But granting the desirability of increased enlightenment along these lines, is there any practical method of applying the present knowledge?

I believe there is. The eugenist may take a firm stand on immigration. A considerable number of physical and mental abnormalities are known to be hereditary. It seems reasonable to demand the exclusion

of families in which such traits exist even if the exact mode of inheritance has not been discovered. Thus something can be done to prevent American manhood and womanhood from deteriorating, and without any particularly harsh or unwise laws.

To deal with the individual cases on the grounds, so to speak, is not so easy. Take feeble mindedness as an illustration. About 70 per cent of the instances of feeble mindedness are hereditary. And though numerous modifying genes change the grade of mental deficiency, the thing that actually prevents the mind from functioning is the defectiveness of a single gene. Feeble minded individuals, when mated, produce only feeble minded children. For this reason, the proposal to segregate or to sterilize the low grade feeble minded is sound. But will this practice eliminate feeble mindedness? It will not. The defect is recessive to the normal condition. And about 200,000 out of our national feeble minded population of 300,000 have appeared in families where normal parents are carrying feeble mindedness in half of their germ cells. I fear that similar crops of the mentally deficient are to be expected in each generation.

One might use the same line of reasoning for several other deleterious recessive traits. The unfortunate possessors of these characteristics may be warned against marrying each other. Occasionally the facts may justify legal action. But presumably the only effective eugenic check on normal individuals heterozygous for such hereditary factors is to dissuade them from marrying close relatives when the family trees show any of this type of fruit.

My own feeling is that the greatest practical eugenic good will come from a very general code of action. Much of what goes to differentiate the high grade from the low grade individual is hereditary, and is inherited in a complex manner due to the large number of genes involved. This is true both of physical and of mental characteristics. If more accurate means of estimating the relative physical and intellectual grade of the individual were discovered, if such examinations were a part of the national health program, and lastly if knowledge of genetic laws were widely diffused, then the more intelligent and healthier people would mate together more frequently. True, the less intelligent and the physical anomalies would also mate more frequently; but with a clearer genetic point of view among our physicians, some control might be utilized as a tool to lessen their reproductive efficiency.

THE DIFFICULTIES NOT INSURMOUNTABLE

Certainly there are difficulties connected with such a scheme, but I do not think that these difficulties are insurmountable, as Pearl has maintained in his article on "The Biology of Superiority" appearing in

The American Mercury for November, 1927. Pearl's thesis is simply this: Owing to the phenomenon of dominance and to the non-inheritance of acquired characters, selective mating of individuals possessing particular qualities does not raise the racial average in these qualities. He says that eugenics is unsound because it is founded on the theory that the children of superior men have a greater chance of being gifted than those of ordinary men. This theory, Pearl assures us, is untrue because "Johannsen showed with the utmost clarity, and a finality that has not been successfully challenged, that a race of superior beans was not to be bred in this way."

I feel convinced that Pearl has not interpreted Johannsen correctly. He is within the facts in stating that the only "guarantee of the worth of a bean (or a man) for the breeding of a superior race was not its own superiority, but the superiority of its progeny." These are the tricks that dominance and the non-inheritance of acquired characters play on us. But when Johannsen was dealing with a genetically mixed race, which of course is what obtains in the human race, he made very rapid progress by selection. Natural selection and artificial selection are the main modes of making progressive changes in the organic world. They do their work by isolating genetically different strains from mixed populations. In fact, Pearl's own figures in this same article show that relatives of great men are much more likely to attain fame than are people taken by chance from the whole population.

If there are persons who build their schemes of improving the human race on a literal and profound faith that "like produces like," as Pearl avers, they have built on a sandy foundation. No doubt some enthusiasts have assumed a higher correlation between body qualities and breeding power than really exists. Like only tends to produce like. The correlation between parents and children, which is the mathematical measure of resemblance, is, in the long run, about 50 per cent, as Galton showed long years ago. It is certainly not 100 per cent, for this would mean that the children of a given pair are identical in appearance and are a perfect blend of the characteristics of their parents. It is just as certain that the correlation is not 0.0. I am afraid that Pearl has been indulging in the interesting game of carving out a toy soldier of his own and then blowing him up with a charge of buckshot.

Clearly applied eugenics is not all plain sailing. It has its difficulties. It also has its possibilities. Must we not, then, take the same attitude regarding it that Darwin took in 1873 when Galton wrote to him regarding his proposed Eugenic Register. Darwin replied: "Your proposed Society would have awfully laborious work, and I doubt whether you could ever get efficient workers. As it is, there is much

concealment of insanity and wickedness in families; and there would be much more if there were a register. But the greatest difficulty, I think, would be in deciding who deserved to be on the register. How few are above mediocrity in health, strength, morals and intellect; and how difficult to judge on these latter heads. As far as I see, within the same large superior family, only a few children would deserve to be on the register; and these would naturally stick to their own families, so that the superior children of distinct families would have no good chance of associating and forming a class."

Thus Darwin with his usual clairvoyance sensed the general perplexities in the situation that I have tried to point out in greater detail today. Our position cannot be greatly different from his if we keep to the facts, in spite of a half century of genetic progress since he wrote. But Darwin also saw the other side of the shield. Following the above paragraph in his letter, come these words: "Though I see so much difficulty, the object seems a grand one, and you have pointed out the sole feasible, yet I fear Utopian, plan of procedure in improving the human race."

And there we are. We shall have many troubles and make many mistakes if we endeavor by a eugenic program to counteract the effect of negating natural selection through our various humanitarian schemes. We shall be damned if we do nothing.

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THE POSSIBILITY OF MODIFYING GERM PLASM

Dr. M. F. Guyer, Professor of Zoology, University of Wisconsin.

The possibility of modifying germ plasm stands as a perpetual challenge to the biologist because the problem of variability, of the origin of new characters, constitutes the very foundation of both genetics and evolution. Until we know more of the causes of germinal variation than we do today, we must remain ignorant of the most essential factor in each of these vast fields. So it is obvious why, although baffled at almost every turn, the experimenter returns again and again to his attack on this central problem.

No biologist today, in the light of the evidence available from the fields of embryology, cytology and genetics, would question the conception that the materials of the germ cells have been derived, in the main at least, from the oosperm by a process of cell-division, for this is the obvious explanation of how hereditary traits already established are handed on. This fact tells us nothing, however, about the acquisition of new genes or about the modification or loss of old ones.

Have the genes in question come into existence through the intermediation of the body, and if so, was the influence general or specific? Are they attributable directly or indirectly to the external physical environment? Have they arisen in the germ cells as the result of internal constitutional changes that bear no direct relation to the body? Or are they the outcome of now one, now another, or of combinations, of these agencies?

THE SOURCE OF NEW CHARACTERISTICS

It is plain from our modern knowledge of genetics that two kinds of variability are recognized: One, the outcome of recombinations of existing genes as observed in the Mendelian phenomena and in abnormal chromosome distribution; the other, the result of changes in the hereditary constituents themselves. The latter, as far as we know, constitute the sole source of actually new characteristics. While at one time biologists attributed great importance to sexual reproduction as a basis of variation and the origin of new characters, our modern knowledge of genetics makes it appear very doubtful that absolutely new characters, or at least new genes, can be originated in this way. What seems to occur, under such circumstances, is merely a reshuffling or resorting of old materials. Although new combinations of genes may be made that afford a valuable basis for natural or for

artificial selection, such a process is not creating genes of new characters in the germ plasm.

There is a considerable body of experimentation, particularly with X-ray and radium, that shows that external influences may sometimes directly affect the germ cells, and there are bits of evidence that occasionally such changes may become hereditary. But even these indications of inheritance are regarded as inconclusive by our more cautious biologists. And there is even greater skepticism about interventions of the parental body affecting the germ cells, particularly in any specific way. Since, on the basis of negative evidence at least, the efforts of the flesh seem unavailing in any perceptible modification of germ plasm, the modern student of heredity almost universally falls back upon the non-committal conception of a directly varying germinal substance, and simply pleads ignorance of the causative stimuli, internal or external, that induce such changes.

THE ROLE OF ENVIRONMENT IN INITIATING CHANGES

But the outstanding perplexity in the field of variation is not so much the mere appearance of changes in the germinal substance as the appearance of the particular kinds of change that eventually lead to that hand-and-glove relationship between organism and environment that we call adaptation. When one tries to view adaptation with mind unbiased by the doctrinal pap of his biological infancy, the accomplished facts seem almost overwhelmingly to suggest that environment must play an important part in initiating as well as in conditioning germinal changes.

Time and again in the past, according to paleontologists, whenever new conditions arose that would permit of the existence of living organisms, new forms of life admirably adapted to those conditions appeared. In some way the environment molds these new inhabitants to its bounds, and it seems well-nigh incredible—no matter what eons of time are vouchsafed us—to believe that this has been done merely by the negative method of killing off generation after generation of the non-conformists. For on such a basis not only has the adapted organism had to await the accidental occurrence of a favorable germinal variation, but of hosts of them, often highly interrelated, which then must be sifted and perfected by natural selection through innumerable generations to bring about that marvelous adaptedness to the environment that characterizes living things.

Various facts of geographical distribution also incline one to suspect that altered function or environment, if long continued, is directly instrumental in molding the fauna of a given region; yet experimental proof of such direct change is lacking. And particularly when one

contemplates the highly specialized adaptations of many parasites does he feel skeptical of the doctrine of an all-sufficient natural selection based wholly on accidental variations. For the adaptive mechanisms or adjustments of many of these parasites, whether such internal forms as intestinal protozoa or such external ones as bird lice, must be of comparatively recent origin. Since they are often so highly specific that they cannot live on even a slightly different species of host, it is evident that they could only have reached their own state of highly specialized adaptation after the host itself had evolved into a distinct species.

COOPERATIVE ACTIVITIES OF VARIOUS PARTS OF THE BODY

On many animals we find evidence of compensatory and other adaptive responses of the body initiated through the agency of the serological mechanisms of the organism. It would seem worth while, therefore, to seek in the same direction for light regarding the possible existence of some form of adaptive germinal impress. For when one perceives the many cooperative activities of the various parts of the body, and how change in one part—such as an endocrine gland—may produce pronounced effects in the furthermost reaches of the body, it seems improbable that the germ-cells, bathed in the same fluids, nourished with the same food, stand wholly apart.

It is a well established fact that foreign proteins of either plant or animal origin introduced into the blood stream of an animal will cause the formation of certain antagonistic or corrective substances to which the general name of *antibody* is applied. The protein substance employed to produce antibodies is commonly called the *antigen.* Although there are several classes of antibodies—*precipitins, agglutinins, bacteriolysins, cytolysins* or *cytotoxins,* etc.—all of them have certain points of similarity, as, for instance, their means of origin, their reaction to heat, and, in some cases, their mode of operation. Chemically their natures are still unknown. Agglutinins, as the name implies, are agglutinating substances. Bacterial agglutinins, for instance, clump bacteria of the species used in their production, if the two are brought together in the blood serum of the animal into which the bacteria were originally introduced. Precipitins are substances that form a precipitate when the blood serum of the treated animal and an extract of the tissue used as antigen are brought together *in vitro;* and cytotoxins or cytolysins are antibodies that possess a toxic, solvent or neutralizing action for the kind of protein used in their production. The various antitoxins in use in medical practice exemplify this latter type of antibody.

In the main the immunologic reactions show a considerable degree of specificity; the antibody will react fully only with the particular kind of protein used as antigen. The specificity is not absolute, however; a milder reaction may be obtained with corresponding proteins of related species, the extent of the reaction being determined by the nearness of the relationship of the species to that from which the original antigen was obtained.

EXPERIMENTS IN GERMINAL VARIATION

The thought occurred to me some years ago that the ideas and methods of the immunologist might be of some use in getting additional light on the biological problems of germinal variation. If it is possible to originate in living animals antibodies that will modify or destroy particular tissue elements, the question arises, Is it not possible to secure similar selective action on the parts of the developing embryo? Or may there not be sufficient constitutional identity between the elements of the somatic cells and those of the germ cells so that the latter may be specifically modified by such serological influences as can provoke specific changes in tissue elements? In an attempt to find answers to such questions, a series of experiments with crystalline lens antibodies and with *Bacillus typhosis* were begun. These experiments are still in progress.

In the first experiments fowls were immunized to rabbit lens by injecting into them emulsions of the pulped lenses of young rabbits. The blood serum of such fowls, containing lens antibodies, was next injected intravenously into pregnant rabbits. There was considerable mortality both of unborn young and of adults. Of sixty-one surviving young from mothers thus treated, four had one or both eyes conspicuously defective and five others had eyes that were clearly abnormal.

The commonest abnormality seen in both the original subjects and in their numerous descendants was partial or complete opacity of the lens usually accompanied by reduction in size of the eye. In a few of the later strains in a different experiment, however, several cases of enlargement of the eye, or *buphthalmia,* occurred. Other common defects that have appeared are cleft iris, displacement of the lens, bluish or silver color instead of the characteristic pink of the albino eye, microphthalmia, and even almost complete disappearance of the eyeball. The cases of cleft iris, or coloboma, range all the way from a narrow slit in the lower edge of the iris to a broad wedge- or U-shaped opening that amounts practically to the absence of the entire lower part of the iris. The cleft may be confined to the iris or it may extend back deeper into the eye. Of more than one hundred of the eyes that have been carefully mounted and studied by an ophthalmologist, Dr. F. A.

Davis, every one showed some degree of coloboma. When one takes into account the embryology of the eye, it is not unreasonable to suppose that the defects may all be attributable to initial lens disorder, which induced aberrances or suppressions of normal eye development.

A second defective-eyed line (the so-called 16A1 line) from stock unrelated to the first line (3A1 line) was subsequently established by the use of lens-treated fowl serum. Still a third unrelated strain (84 line) was secured by directly injecting pulped rabbit lens intravenously into the pregnant mother, thus leading her to develop antibodies in her own blood. Only one of eleven rabbits thus injected produced defective-eyed young.

The experimenters also secured lens defects on two separate occasions in young guinea-pigs by treating one pregnant mother with pulped swine lens and another with pulped rabbit lens, but the young in question died before the inheritability of the condition could be determined. Finally another investigator working in my laboratory with pedigreed lines of a large variety of rabbit known as New Zealand Reds, secured one defective-eyed young individual by using on the mother sheep serum immunized to rabbit lens.

As reported in their various papers [1] on the subject, the experimenters had many more negative than positive results. It should also be recorded that several investigators who have attempted to repeat the experiments have obtained only negative results with possibly one doubtful exception. The condition is evidently not an easy one to induce. Many complex factors are involved and it is extremely difficult or even impossible to secure similar conditions in all respects.

DEFECTS ESTABLISHED IN INDIVIDUALS BECAME HEREDITARY

The fact of greatest interest in the experiments is that once the defect is established it is hereditary, having in general the characteristics of a Mendelian recessive. Moreover it can be transmitted through males as well as females, hence it is an example of true inheritance and not merely the passing of antibodies from mother to young by way of the placenta.

The same genetical conditions hold for all lines. In the 3A1 line, for example, without any further serum treatments it was inherited through nine generations, until that strain was exterminated in a series of epidemics that swept through the experimenter's rabbit colony in 1923 and 1924. There is no reason apparent why such defects may not be transmitted indefinitely. The imperfections tended to become worse in successive generations, and also to occur in a proportionately greater number of young. This may have been a result of inbreeding,

1. Guyer and Smith: Jour. Exp. Zool., 26, 1918; do. 31, 1920; do. 38, 1924. Guyer; A. M. Nat., 59, 1925.

but the facts also suggest the possibility that the degenerating eyes might themselves be directly or indirectly originating antibodies or other chemical substances in the blood stream of their bearer that in turn affected the germ cells. For such bodies, once established, should be as effective in modifying germinal factors as corresponding antibodies introduced into the fetus through the placenta.

Certain it is that an animal will on occasion build antibodies against its own tissues when these are modified, for I have repeatedly caused the production of spermatotoxins [2] in rabbits by intravenous injections of their own spermatozoa, and have produced lens precipitins in the blood stream through needling the lens of the eye. I have also found that when opacity of the lens is caused by exposure to ultra-violet light, lens precipitins may appear in the blood of the experimental animal and that they may also occur in the blood of human patients suffering from cataract. Furthermore, an assistant, P. S. Henshaw, finds that guinea-pigs that have had their skins exposed to irritating doses of ultra-violet light develop skin precipitins in the blood and may undergo severe anaphylactic shock when injected with a solution of pulped guinea-pig skin.

PROOF THAT RESULTS WERE OUTCOME OF EXPERIMENTAL TREATMENT

The first suggestion that occurs to a geneticist when he encounters such an experiment as the foregoing on eye-defects is that perhaps by inbreeding the experimenters have merely uncovered a recessive defect already present in the stock. In reply to this, as regards the first defective (3A1) line, it can be said that other litters from the same parents were secured and none of them or of their numerous descendants, although bred as brother and sister matings, have shown the defects. Even when 3A1, the first defective-eyed male secured, was bred back to his mother, the five resulting young had normal eyes. Likewise, in the second line, intensive inbreeding was practised among the untreated brothers and sisters of 16A1 and their progeny, and none but normal-eyed offspring was secured.

But even supposing the experimenters by chance just happened in their first experiment to hit upon an individual that was carrying a recessive eye defect ready to be revealed in her descendants after treatment with serum immunized against rabbit lens, it is improbable that a similar defect would also happen by chance in the unrelated 16A1 line, and the theory of chance surely becomes untenable for a third (84) line, to say nothing of the case secured in a pedigreed line of New Zealand Reds or the two cases mentioned in guinea-pigs. Whatever the final explanation of just what has taken place in the

2. Guyer: Jour. Exp. Zool., 35, 1922; Jour. Infect. Dis., 37, 1925.

germ plasm may be, it seems reasonably sure that the results are in some way the outcome of the experimental treatment.

While it is true that individuals with congenitally defective eyes do appear occasionally in such animals as rats, mice, guinea-pigs and rabbits, such anomalies are certainly by no means common in rabbits. In more than two thousand young born during my work with rabbits, I have encountered only one instance: An apparently normal female produced one totally eyeless and one abnormally small-eyed young in the same litter. Even such so-called "spontaneous" defects, however, do not arise uncaused although we are ignorant of the cause.

EVIDENCE POINTS TO SPECIFICITY OF DELETERIOUS AGENT

The question of whether the effect is a general one, due to a general poisonous or inhibitive influence, or whether it is a specific one, due directly to lens antibodies in the blood serum, is a difficult one to answer certainly. The general inclination of an embryologist, knowing how susceptible in early embryogeny the eye is to any kind of deleterious agent, is to regard the result as of a general nature. The evidence from the experimenters' controls all points, however, toward specificity. Never in well over fourteen hundred young born from mothers that had been subjected to just as violent or even more violent serological treatments in various other experiments has a single instance of eye defect appeared. Eye abnormalities have occurred only when a foreign serum that contained lens antibodies was used, or when the mother's own serum carried antibodies developed against lens injected directly, or against her own lenses, following injury, after the manner next to be described.

In later experiments I found that, when its lens is injured, a normal rabbit will frequently develop lens antibodies[3] in its own blood serum. In such operations the eye is treated with a local anesthetic, then pierced with a needle by means of which the lens is more or less broken up. The procedure is the same as that commonly followed by ophthalmologists in cases of children with congenital cataract. The serum of all rabbits used in such experiments was first tested for rabbit lens precipitins and without exception found negative. In from 7 to 10 days after the needling operation, the serum of each rabbit was again tested for lens precipitins. Of 23 rabbits thus treated, 10 gave negative, 2 questionable, and 11 positive results. Some of those that were negative after the first operation gave positive reactions after a second operation.

A number of rabbits are under experiment at present to determine whether or not transmitted defects, similar to those of the earlier

3. Guyer: Jour. Infect. Dis., 37, 1925.

experiments, result from this method. These experiments are of too short duration to be reported in detail beyond relating that out of 33 needled females (some of them reneedled between litters), five have borne one or more young in some of their litters with one or both eyes defective.

Whether or not the eye-defects induced thus by direct operation on the parents are inheritable remains yet to be determined. Most of the young secured in these last experiments died in an epidemic that swept through the stock of experimental animals. The experiments are being repeated, however. Also, experiments with the individual lens proteins are being undertaken. The only one of these so far that gives evidence of any influence is *Beta-crystallin.*

A POSSIBLE VARIATION IN SUSCEPTIBILITY OF DIFFERENT ANIMALS

In a later experiment with albino rats, the writer obtained 308 normal-eyed young from 20 needle-eyed mothers. That is, there was no perceptible effect on any of the young. On the other hand, when 68 female and 5 male guinea-pigs were similarly needled and mated, 60 of the females bore 92 young, among which were 11 defective-eyed young from 8 different mothers. These two sets of results raise the question of whether or not certain kinds of animals may not be more susceptible to such operative procedure than others. Also it suggests the possibility that certain strains of the same kind of animal may be more easily influenced by such operations than others. This matter is being investigated.

WAS IT AN EXAMPLE OF THE INHERITANCE OF ACQUIRED CHARACTERS?

I am often asked if these experiments do not afford examples of the inheritance of so-called acquired characters; that is, of characters first acquired by the body and then passed on to the germ. I myself have never felt that they are as yet sufficiently conclusive to warrant such an interpretation, although some of them are suggestive of it. The truly hereditary nature of the anomaly is beyond question and there is little reason to doubt, I think, that it has been engendered in some way by means of the serum treatments. One's inclination, from knowledge of the field of experimental embryology, is to attribute the initial defect to a general poisonous or inhibitive agent, yet all the results in the actual experiments checked by over fourteen hundred controls point to it as specific rather than general. Never was the defect obtained except in association with a serum carrying a specific antibody.

It is not yet clear whether the eye of the fetus is first changed and the condition is then conveyed from it to the germ cells of this indi-

vidual, or whether the eye and the germ of the fetus are influenced separately by the antibodies that have entered from the mother's blood by way of the placenta. Only the first occurrence could be interpreted as the inheritance of a somatic change; the second would be an instance of what is known as parallel induction. Strictly interpreted, even in the defective-eyed young of mothers with needled lenses, provided the condition proves inheritable, the same two alternatives confront us. Until adequate outbreeding experiments with needle-eyed males have been made, the question must remain unanswered. Such experiments are in progress.

EXPERIMENTS ON TRANSMISSION OF INDUCED IMMUNITY

If such studies as these on induced eye-defects seem at their present stage to have little if any bearing on the problems of human welfare which are the concern of a Conference such as this on Race Betterment, there is perhaps more of practical significance in another line of experiments that I, together with various research assistants, have been conducting on the transmission of induced immunity.[4]

It is well known that after recovery from an attack of any one of certain diseases, various animals, including man, are more or less immune to further attacks of the same disease. The question arises as to whether or not such immunity is transmitted to offspring. Repeated experiments on guinea-pigs, rabbits and human beings have shown that in such forms the young born of mothers immunized during pregnancy are immune at birth but that apparently the immunity is soon lost. The effect is regarded as one of direct placental transference from the blood of the mother. Indeed, temporary immunity can be produced in young animals merely by having them nurse from an immunized mother. Using typhoid agglutination tests, we found, however, that in rabbits, while the young of normal untreated mothers nursed by immunized mothers lost their acquired titer rapidly after weaning time, the young born of immunized mothers, even when nursed by non-immunized mothers with negative agglutination titers, maintained their typhoid titer for some months, and in some instances even transmitted it to their own offspring. This indicates that in the latter, which have acquired their immunity reactions through placental transmission, some mechanism, concerned with the production of antibodies, has been influenced in the young that was left untouched by such passive transfers as occur through milk. Moreover, we found that in subjecting successive generations of rabbits to typhoid innoculations, considerably higher agglutination titers (and presumably there-

4. Guyer and Smith: Jour. Infect. Dis., 33, 1923; 35, 1924.

fore increased immunity to typhoid) could be developed, in individuals of strains that had been under immunization for three or four generations, than in first generation animals or in previously untreated stock. Whether or not subsequent experimentation shows this to be a truly hereditary immunity or merely some sort of cumulative placental transmission, the practical possibility presents itself that by such means a general population might in time be made to become more or less immune to a disease.

HOW ARE SUCH ACQUIRED CHARACTERS RELATED TO THE GENES OF THE GERM?

Results of this kind, however, it seems to me, open up anew the question of whether bodily adjustments to a changed environment may not constitute a fostering influence that favors eventual crystallization into a more germinally fixed type of heredity. The truth is that in the very setting of the problem of the inheritance of somatic acquirements, we are faced with an apparently insoluble dilemma. For the very fact that a character can be acquired by the body carries with it the unescapable admission that the constitutional capacity for the character already exists.

It is a commonplace of modern genetics that any characteristic of an organism requires not only an adequate stock of germinal materials, which we call genes, but a suitable environment for its production. From this point of view, an acquired character is one in which not the *genic constitution* but the *environment* has been changed. The very fact that it can be called forth by a particular environment shows that the possibility of its expression already existed in the genes when a suitable evocative stimulus was forthcoming.

Such a statement of the problem, however, reasonable as it may be, meets the immediate challenge of explaining how such an acquired character is related to the genes of the germ, but inasmuch as we do not know how any character, acquired or otherwise, is related to the germ, our ignorance is no more dense than it was before. Certainly if our modern knowledge of genetics teaches us anything, it is how little we know about the relationship that exists between the chemical complexes of the germ and the expressed characteristics of the body. We know that any so-called character of the body is the indirect, cumulative product of a long series of interactions of these original chemicals: that great numbers of genes must cooperate to produce even the simplest character; that no one of these genes more than another represents the character in any literal sense; and that any particular gene influences not only one but many, possibly even all, characteristics of the body.

So, in what respects the germinal predispositions which permit of the appearance of so-called acquired characters under special conditions, in what respects they differ from the predispositions that lead to the appearance of so-called inherited characters under usual conditions, no one knows. About all we can say is that in case of what is commonly regarded as the inherited character, the character is such that it is capable of reappearing in successive generations without being called forth each time by a specific environmental factor. But since, as we have seen, the potentia of acquired as well as of inherited characters must in some manner exist in germinal protoplasm, the difference would seem to be one of degree or of fixation rather than of kind.

INDICATIONS THAT GERM PLASM IS NOT A FIXED, INVARIABLE THING

What apparently would have to happen, in order to have an acquired become an inherited character, would not be the germinal creation of the capacities for its appearance—these must already exist or it could not appear—but some sort of germinal fixation that establishes it as a part of the more habitual expression of the germ plasm.

That profound shifts in the organization of the germinal protoplasm may occur, particularly in the order of the appearance of characters in individual development compared with the order of their evolutionary acquisition, is evident when one regards the frequent precocious appearance of an adaptive mechanism far in advance of the conditions under which it is to operate. The eye of the unborn mammal, for example, develops long before it encounters the external agent light upon which it depends for its very significance. Yet, if our conceptions of evolution mean anything, the vertebrate eye must originally have developed in some sort of functional cooperation with light, no matter whether we regard light as a causative or merely as a selective agent. The point I would like to make is that, as time goes on, adjustments do come to pass in germ plasm which may alter the chronological relations of hereditary acquisitions, and that this indicates that germ plasm is not a fixed, invariable thing.

NEED OF FURTHER KNOWLEDGE OF PROTOPLASMIC BASIS OF HABIT-FORMATION

To return to the subject of acquired immunity, or of any other active adaptation for that matter, it would seem not improbable that the acquired adjustment, based on the casual potentiality of the genes of the organism, repeated generation after generation, if only by the negative process of selection, would foster successively immunized gen-

erations of individuals until such casual reactions of the genic complex became its customary reaction.

In conclusion let me say that I am aware that I am offering no explanation of how casual potentialities of the genes that permit of the somatic acquirement of characters become ingrained in the mechanism which underlies the more independently recurrent characters called hereditary. Obviously both types of potentiality must reside in germinal protoplasm. It may be that when we learn more about the protoplasmic basis of ordinary habit-formation, we may also see our way toward an understanding of the origin of inherited adaptations, but until we do so, we shall probably remain in our present ignorance of this most elusive attribute of all living things.

THE CONTROL OF HEREDITY

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This and other Conferences on Race Betterment are born of the conviction that *knowledge,* rightly and sufficiently applied, will better the condition of our race. It is my purpose to ask whether, as a means to this end, we are here and now placing an undue emphasis upon *present* knowledge.

Are we seriously considering the now unknown but attainable thing that would serve our purpose best? As practical persons, we realize, of course, that it is only present knowledge that can be applied now. But can leaders in thought and action on this matter permissibly fail to direct some positive effort toward bringing into existence the kind of new knowledge and power that would perhaps serve us precisely and best?

The facts that fall within my sphere of research seem to suggest that the greatest force for Race Betterment really lies in the control of heredity; that the theoretic possibility of such control is already demonstrated, though the fact is very little recognized; and that there neither is nor has been—but should be—an organized research in this field that would look definitely to the control of *human* hereditary characteristics. If I have anything to contribute to this Conference, it is a brief development of this point of view.

CONTROL OF RACIAL DEGENERATION

At the outset of this discussion it will occur to many that to an extent we are controlling the heredity of the race when we withhold the right to reproduce from those who possess certain undesirable traits; and when, by knowing beforehand the hereditary behavior of various human characteristics, we obtain evidence as to which types of individuals should and should not be permitted to reproduce. To an extent this is true, although at best this type of control can only combat racial degeneration. It is necessary, however, to indicate at once that this useful type of control does not at all involve what we here mean by "the control of heredity." In the cases just mentioned, the attempt is to prevent new or further combinations of particular genes or factors that have been found undesirable, and to favor other combinations. Besides the seemingly permanent limitations to its practicability, this desirable type of control, even if quite successfully applied, would still

leave the race composed of what we may call average normal and super-normal individuals; and each of these groups, in every generation, would in turn yield a fair proportion of defectives and abnormals. There is good and sufficient genetic evidence for this. Under democratic government the only type of control of reproduction that will be both practicable and desirable is limited to certain criminal, quite abnormal, insane and feeble minded individuals.

THE NEW DEFINITION OF HEREDITY

The real nature and rôle of heredity is much misunderstood. Moreover, it is usually so described as to place in a false and inferior light some of the most significant advances being made in other branches of biological research. Accumulated advances in developmental physiology, in genetics, and in experimental morphology, have supplied us with a much revised definition of heredity. It is important that this relatively new conception of heredity should rapidly become known to others than the very few who are now continuously conscious of its redefinition. It has become clear that the specific *conditions* under which a gene or factor operates and develops have an equal value with the germinal factors in the appearance of anything that can be called heredity. The factors distributed by germ cells set limits to the nature and appearance of adult characteristics. So do conditions. To use the recent apt words of Jennings (1925), "The characteristics of the adult are no more present in the germ cells than are those of an automobile in the metallic ores out of which it is ultimately manufactured. To get the complete, normally acting organism, the proper materials are essential; but equally essential is it that they should interact properly with each other and with other things. *And the way they interact and what they produce depends on the conditions.*"

HEREDITARY FACTORS AND CONDITIONS OFFER GREATEST OPPORTUNITIES OF CONTROL

There is no heredity apart from both hereditary factors and conditions. The problem of "control" can be approached from either side. The facts familiar to me lead to the conclusion that it is through the control of *conditions* that man will exercise his greatest control over his own heredity. Only through the control of conditions has *mankind* a reasonable hope of soon becoming something distinctly superior to what it now is. This has been quite so during the past several thousands of years. The civilized man of today is very doubtfully superior to the cave man in his hereditary factors; but he is much superior because of the social, economic, medical and educational conditions that protract and extend his development.

The matter of control through "factor" or "conditions" may, however, become a far different thing if instead of man we are concerned with cultivated plants and domesticated animals. In these organisms limitless selection and elimination can follow the keen edge of segregation and the application of other principles of genetics. In these fields, though much has been and will continue to be done by controlling conditions, the most practical, durable and far-reaching control is probably to be attained through the genetic factors. A desirable mutation in wheat can soon supplant most or all other varieties of wheat. But it is billion-counted man as he is, not a rare variant of him, that is to continue the human race. In the wide-flung network of human germ plasm there is at millions of points, probably within every individual, a mixture of factors for both good and bad traits. And the union of factors derived from any two individuals will bring into existence a special combination of these myriad traits that rarely or never has existed before. The effect of any such new factorial combination on the development of the many adult characteristics is, in any particular case, largely unpredictable. For in only a few characteristics—mostly found in very special types of individuals and with conditions here left undisturbed—a certain measure of prediction is possible. This fairly expresses the situation involved in any attempt to grapple and control the distribution of the genes and factors now present in the network of human germ plasm. It is high time that those occupying themselves with Race Betterment should frankly face and recognize the relatively meager changes in the human race likely to be wrought from this source.

A very different situation is met with when our efforts at control are centered upon the control of *conditions*. Here the scope of promising and successful effort is nearly or quite unlimited. True, at the moment we may be able to accomplish relatively little in the human, though a part of the reason for this must be sought in the odd circumstance that only a very few things thus far have been adequately attempted in the human. We have not yet really tried at all to grasp the superior thing that lies just beyond an unaided reach. Under the redefinition of heredity, however, we must recognize that most or all that is accomplished by way of education, sanitation, medicine, and changed social environment is an application of the control of heredity through a control of conditions brought to bear on the individual. In these matters we are not at all trying to change genes and factors; we are trying to furnish the specific conditions necessary for a desired development of hereditary characters.

Heredity is controlled whenever and wherever an aspect of development is controlled. The accomplishments of experimental biologists already make it clear that there are probably few or no aspects of development for which a wide measure of control is not theoretically possible in man. It is of course obvious that such control is attended by special practical difficulties in the case of man. But we must here sharply illustrate the rôle played by conditions in heredity. It is against that picture that we can advantageously consider the need for an organized research directed largely to the removal of the practical difficulties of similar control in the human. Since serious studies involving an early and far-reaching control of development have been practically confined to animals, it is natural that the examples of control that can now be cited have been obtained on animals. Something of the nature and scope of some characteristic successes in the control of heredity is indicated by the few following cases.

EXAMPLES OF CONTROLLED CONDITIONS

We may begin with the versatility of a salamander, the Mexican Axolotl. In its native locality this animal lives in the water, breathes by means of gills, and throughout its entire life has the other characteristics of a water animal. Generation after generation it lays its eggs and reproduces in this condition. If, however, it is transplanted to certain other regions, or is forced during three or four months to spend a part of the time in air, or if it is fed a little thyroid tissue, it then becomes a land animal. It loses its gills, develops lungs, and becomes an altogether different individual. Its hereditary factors are the same for it as a land animal and as a gill-breathing water form; conditions alone determine whether it is the one or the other of these two very different things.

A second example will show that large stature, or gigantism, can be made to form from the same hereditary factors that form an animal of normal size. When the same salamander described above is permitted to feed on a specific substance—the anterior lobe of the pituitary body from a higher animal—this salamander becomes nearly twice as large as when it feeds on its normal diet of earthworms (Uhlenhuth, 1923). Here very large stature is a gift within the power of the experimentalist who has learned and applied a specific fact concerning heredity—i. e., concerning the resultant in development of the same factors subjected to specifically different conditions.

Again, in some lower organisms it has been found possible to change or to reverse the basic pattern—the polarity—of the organism. Special conditions supplied by the observer (Child, 1924; see also studies of Speeman, and of R. G. Harrison) have determined that

regions or tissues that would otherwise form the tail should instead form the head.

In a fourth case the experimenter may decide whether certain fishes are to develop two eyes or only a single median one. Two eyes form under usual conditions; but single-eyed individuals can be obtained merely by adding a depressant—various anæsthetics or a magnesium salt—to the water in which the eggs develop (Stockard, 1909).

As a fifth example we take a certain stock or race of the fruit fly, *Drosophila,* provided with hereditary factors usually resulting in the formation of an extra number of legs. Further studies of this race showed that if the eggs and young bearing these variant hereditary factors are merely grown at a high temperature, instead of at the usual or lower temperatures, they do not form the extra legs. They then masquerade as quite normal individuals (Hoge, 1915).

As a sixth case of the control of heredity we may use a character no less widespread among organisms, and no less deep-seated within an organism, than sex. In several lowly organisms, and at least in such higher ones as the frog (Hertwig, 1912; Kuschakewitsch, 1910; Witschi, 1925) and bird (Whitman, 1919; Riddle, 1916), the sexuality of the individual has been changed or reversed by the experimenter. In the case of the frog, as simple a matter as forcing the eggs to undergo an early development in an abnormally high or an abnormally low temperature will change the sex of some individuals. Other methods of changing the sex of frogs, birds and other animals are a bit more complicated. In some cases, however, the crossing of races, species or genera is mainly involved, and all of the various procedures are steadily becoming better understood.

AN EXAMPLE OF CONTROLLED HEREDITY IN MAN

This audience would doubtless particularly wish the citation of instances in which the control of heredity has already been effected in man, or at least in mammals. For this purpose two examples may be cited. The first of these requires a rather extended statement.

The control of color development is one of the most enlightening and fascinating chapters that could be written concerning living things. This is partly because we know more about the chemical mechanisms involved in the formation of color than we know of any other hereditary characteristic. Fortunately, too, the factors or genes that particularly affect color are also fairly well known in several animals. We also quite definitely know, as the result of numerous studies, that the formation—the heredity—of color is modified with remarkable ease. These studies make it entirely clear that one and the same hereditary constitution can be made to produce quite different colors.

Long ago Schmidt (1896) was able to review a large number of already known cases where the injury to a nerve supplying one part of the human body was accompanied by changes in the melanin color produced within the area supplied by the affected nerve. This certainly showed that the color of man is not merely an expression of his color factors. The hands of the experimentalists have remained idle where the human was concerned; the implications of the control obtained in animals have not been utilized on man. But the extent and variety of control—and the great insight into the general subject that he has meanwhile obtained on animals and in test tube—is so great as to supply some gratifying compensation. And, here as elsewhere, perhaps considerably more can profitably be learned on animals before suitable methods are available for the control of color in man.

In 1908 Bertrand showed that a number of simple phenol-like compounds, among these the amino acid tyrosine, can be oxidized to various stages under the influence of the enzyme tyrosinase; also that these various stages of oxidation yield a color series—beginning colorless (white), yellow, brown, black. This chemical series is notably similar to the biological color series that had just been obtained on amphibia by Tornier (1907). In the following year (1909) the writer was able to point out that the adult color of an organism is a thing essentially controllable irrespective of the type or kind of hereditary color factors borne by the organism. Since that time investigations have indeed made it clear that there are very many genes or factors that have great influence—under normal or unmodified conditions they will of course decide—on the amount and type of color present in an individual; but further results have also well confirmed our view that from one and the same heritage of color factors a wide variety of colors can be produced by controlling the conditions under which development is permitted to proceed.

Schultz (1915 and 1920) shaved some of the white hair from the back of a Russian rabbit and then subjected this animal to low temperatures. After several days of exposure to cold the unprotected naked area of white skin turned black and the hair that grew out from this space was black hair, not white. Hance (1927) could so graduate dosage of X-rays on black mice as to produce white hair, not black. In the various studies of Schultz and others, certain combinations of hereditary factors in other than Russian races of rabbits and guinea-pigs were found to affect the ease and degree of control by Schultz's single simple procedure. But the control of color by one or another change of a specific condition is the important and salient fact from these several studies.

CONTROL OF THE AGE OF MATURITY

As a last example of this type of control of heredity, we refer not so much to a specific case as to a condition that is rapidly developing. Enough is being learned concerning the various organs of internal secretion to make it clear that these organs are supplying some of the richest materials with which the future will be equipped for the control of a wide variety of developmental processes in the human being. An outstanding case demonstrated within recent months involves the fact that when an anterior pituitary body is transplanted daily from mature mice and rats into immature mice and rats, these latter almost immediately—within 8 or 10 days—become sexually mature (Smith, 1927). In short, the age of maturity in a mammal is coming under control.

In line with present and probable future developments of our knowledge of the internal secretions, it is not too much to expect that these substances, in addition to their use in combating disease, will find a very special sphere of employment in the control of typical developmental processes of the human. Indeed already the physician is thus employing some of them to develop or activate such processes as growth and reproduction—both typical developmental (hereditary) things. These particular instances also suggest that much—possibly all—of the means of hereditary control that the future brings will be exercised upon the human through the physician or medical specialist of that day.

This short and very incomplete review indicates that the control of development—which is truly a control of heredity—has already been multifariously accomplished in animals. This control includes: The production of the giant; the gill breathing or the air breathing animal; the reversal of tail to head; two eyes or one eye; normal legs instead of extra legs; female changed to male, and the reverse; white to black, or black to white; and the almost infant mammal made sexually mature. How much further may the experimentalist be expected to go before his findings are applied to man? Are the best results of three or more decades of experimental biology to remain half anesthetized as "academic" things? Or shall we give them their full awakening by taking the steps still necessary to their application in the life of man?

MODIFICATIONS OF GERM PLASM

For a moment it is now necessary to consider another type of control of heredity—a type of control that indeed deserves attention but must here receive little. The reference is to modifications of the germ plasm itself. Harrison (1926) has described remarkable cases in moths. The moth larvae that were fed on plant leaves to which lead nitrate or

manganese sulphate had been added were found to develop a black melanin color; and some of the larvae thus treated were shown to possess a modified germ plasm, since their offspring were capable of producing black pigment without having to be fed on lead and manganese salts. Guyer (1925) has also supplied evidence that rabbits injected with the products of the crystalline lens of other rabbits have had their germinal factors for lens production so modified as to produce abnormal lenses. Muller (1927) still more recently finds that by means of X-rays he has modified the rate at which mutational changes occur in the germ plasm of the fruit fly.

PRACTICABILITY OF CONTROLLING CONDITIONS

But the control of heredity through a control of conditions is here our main thesis. If the several facts already cited demonstrate the practicability and wide applicability of this type of control of heredity, it still remains to consider our practical failure to do anything about it. The development of fact and theory have reached the point where—unless we are to bury the treasure accumulated by a large section of biological science—it is obviously necessary to initiate an organized research whose purpose it should be to find the technique necessary for effecting some of the many possible developmental controls on human beings. We are indeed already applying such of these powers as we now possess in education, social environment and in medicine; in these fields we make use of precisely the same type of control of heredity. But marvelous and unrivalled as these results are, in the main, these influences merely serve to project and to extend the *end points* of our faculties and capacities. Why not put ourselves also in position to supply education and medicine with quite new and greatly advanced *end points,* through our power to modify the physical and mental substrata of the developing individual?

There are research institutes on almost every other conceivable subject. Here, even awareness of the need for an organization definitely directed to this end seems still to be created. In view of the diversified and effective control already obtained in unorganized and isolated animal experimentation, this would appear to be a late day for beginning a matter that so vitally concerns the future of man.

By no means can an organized research on this subject be said to exist among the isolated experimenters now steadily adding to the examples of control to which reference has been made above. The control of life phenomena, particularly those of developmental phenomena in man, is one of man's most difficult tasks. Living matter is by far the most complicated form of matter, and if in man a controlled

distribution of genetic factors is quite beyond reach, the control of conditions here also encounters the maximum of difficulties. For any rapid advance in the application of our knowledge of the control of heredity to man, it would seem clear that the attack is nearly or quite impossible to isolated investigators. Perhaps no fewer than ten men would be required to bring together all of the disciplines necessary to a really successful attack on this essential and complex problem. Their number would doubtless necessarily include experimental morphologist, geneticist, physiologist, embryologist, bacteriologist, biochemist, chemist, physicist, pathologist and ethnologist.

NEED OF ORGANIZED RESEARCH

The force of the argument for the possibility of a far-reaching control of heredity through the control of conditions will be admitted, at least as a mere intellectual point, by most biologists. It is believed that all who are prepared to admit the far-reaching scope of conditions in the control of heredity will concede the need and value of an organized research directed to this end. The first move toward the initiation of such an organized attack upon the problem of the control of heredity, as this is visualized here, nevertheless remains to be made. The need is as extensive as the number and distribution of human kind. The special call for its realization would seem to fall on our own rich country, in which it should be possible to obtain the funds and organization necessary to the realization of a project of such proportions and of so great concern to the welfare and advancement of man. Is this not a matter of real concern to this Conference?

Democracy and human nature will probably narrowly limit the extent to which we may apply even our present knowledge of proper matings, and also our doctrines as to which germ plasms are deserving of parenthood. Important as these prescriptions may be, and though the race as a whole may profit, they will be applied directly to but a small fraction of the human race. Nearly the whole race, however, now grasps at the aid that brings a release from pain and disease; and most of it would also readily join in seeking the greater resistance to disease, the greater physical and mental strength, the greater length of life, the more desirable type or degree of the multitude of characteristics that a new knowledge of the control of human development (embryonic, infantile, later) would give them.

But a further—possibly the supreme—result of the application of power of developmental control among men would rest on the transformation it would bring to the mental outlook of man. Ignorance may never disappear; but myth, superstition, and verbal dalliance, will

not commonly survive a wide application of that kind of knowledge that controls and transforms *human* capacities. When on man himself is exercised the power that has already been exerted on experimental animals, the mind of man, even of the bystander, will not only grow, it will find freedom. When this is achieved, I take it that most of the aims of this Conference will have been accomplished.

Bertrand, G. 1908. Recherches sur la melanogenese: Action de la tyrosinase sur la tyrosine. Ann. de Inst. Pasteur, Vol. 22, p. 381.

Child, C. M. 1924. Physiological foundations of behavior. Chicago.

Evans, H. M., and Long, J. A. 1922. Characteristic effects upon growth, oestrus and ovulation induced by the intraperitoneal administration of fresh anterior hypophyseal substance. Proc. Nat. Acad. Sci., Vol. 8, p. 38.

Guyer, M. F. 1925. Soma and germ. Am. Nat., Vol. 59, p. 97.

Hance, R. T. 1927. Altering a matured genetic character. Jour. Heredity, Vol. 18, p. 377.

Harrison, J. W. H., and Garrett, F. C. 1926. The induction of melanism in the Lepidoptera and its subsequent inheritance. Proc. Roy. Soc. B, 99 B, p. 241-263.

Hertwig, R. 1912. Ueber den derzeitigen Stand des Sexualitätsproblems. Biol. Zentralbl., Vol. 32.

Hoge, M. A. 1915. Influence of temperature on development. Amer. J. Zool., Vol. 18, p. 241-298.

Jennings, H. S. 1925. Prometheus. New York.

Kuschakewitsch, S. 1910. Entwicklungsgeschichte der Keimdrüse von Rana esculenta. Ein Beitrag zum Sexualitätsproblem. Festschr. f. R. Hertwig. Bd. 2, p. 61-224.

Muller, H. J. 1927. Artificial transmutation of the gene. Science, Vol. 66, p. 84.

Riddle, O. 1909. Our knowledge of melanin color formation and its bearing on the Mendelian description of heredity. Biol. Bull., Vol. 16, p. 316-351.

Riddle, O. 1916. Sex control and known correlations in pigeons. Amer. Nat., Vol. 51, p. 385-410.

Schmidt. 1896. Ergeb. der Pathol., Bd. III, Abt. I, p. 551.

Schults, W. 1915. Schwärzfarbung weisser Haare durch Rasur und die Entwicklungsmechanik der Farben von Haaren und Federn. I Arch für Entw. Mech. der Organismmen. Vol. 41, p. 534-557.

Smith, P. E., and Earl T. Engle. 1927. Experimental evidence regarding the rôle of the anterior pituitary in the development and regulation of the genital system, Amer J. Anat. Vol. 40, p. 159-218.

Stockard, C. R. 1909. The development of artifically produced cyclopean fish, the magnesium embryo. Jour. Exp. Zool., Vol. 6, p. 285-338.

Tornier, G. 1907. Nachweis ueber das Entstehen von Albinismus, Melanismus und Neotemie bei Fröschen. Zool., Anz., Bd. 32. p. 284.

Whitman, C. O. 1919. Posthumous Works, Vol. 2, Publ. No. 257. Carnegie Institution of Washington.

Witschi, E. 1925. Studien ueber Geschlechtsumkehr und sekundäre Geschlechtsmerkmale der Amphibien. Arch. f. Ver. Socialanthr. und Rassenhyg., Bd. 1, p. 9-179.

WHO OUTBREEDS WHOM?

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Through the past from time to time conditions have caused some human types to outbreed other types, with the result that after a while the bulk of the population came to consist of descendants of fast-breeding types. The process attracted no attention, however, and people remained profoundly unaware that the very fibre of the race was being altered. Today scientific men notice and study a thousand things of which our ancestors were unconscious and one of these things is the unequal contribution of the various population elements to the make-up of the next generation. Thanks to the growing abundance of reliable vital statistics, we have become aware of two tendencies of the last fifty years that cooperate to increase the representation in the people of the offspring of the less desirable human stocks and cut down the representation of the capable and the gifted.

THE PLANING DOWN OF INEQUALITIES IN MORTALITY

One of the outstanding developments of our time is the fighting of disease and the promotion of health by means of *public agencies,* the services of which are free to all. Thus the municipal health department abolishes nuisances, inspects dwellings and schools, looks after the food and drink offered to the public and stamps out communicable diseases. The county health department safeguards milk and meat supplies, exterminates malarial mosquitos, conducts the medical examination of school children, inoculates against typhoid and vaccinates against smallpox. The state health department wrestles with such state-wide problems as the curbing of epidemics, the protection of public water supplies, sewage disposal, factory inspection and the purity of food and drugs. Among the new developments are the following:

The public clinic. In place of the old-fashioned charity dispensary, with its hasty glance and a bottle of medicine for the "deserving poor," has grown up the public clinic, emphasizing health education and disease prevention and cooperating with hospitals and private physicians for thoroughgoing treatment. Developed out of infant welfare and tuberculosis campaigns, it has been extended to meet such problems as venereal disease, heart disease, etc. In the City of New York alone in 1926 there were listed not less than 230 such clinics.

The health center. Within the last fifteen years the health center idea has been spreading widely in the United States. Whereas in 1917 about a dozen were in existence in the larger cities, now about a

thousand such centers are functioning. There is good ground for expecting that the maintenance of permanent tax-supported health centers will presently become a matter of course among us as it is in England, which has already upwards to two thousand such centers.

The infant welfare station. In Great Britain it is proposed to have continuous health supervision of the child, beginning with the prenatal clinic. A continuous record is to be kept from the moment of birth through the period of pre-school life, of grade schools, secondary schools, and in fact, throughout all the years of childhood and of adolescence. In the United States, the Federal Children's Bureau is fostering the same plan. Rhode Island seems to be the first state that has definitely committed itself to such work, beginning with the registration of the birth and continuing throughout the school life of the child. It is planned to turn over a complete health record of the child to the school authorities when the child is entered at school.

Public health nursing. The visiting or public health nurse, whether in the employ of the community or of a philanthropic organization, goes out into the homes of the people to work for the improvement of their health and general welfare. In the twenty years 1900-20, the organizations engaged in public health nursing have increased in number from 58 to about 4,000 and the number of nurses employed by them from 130 to above 11,000.

Health education. In seven years of intensive effort to search out, care for, and prevent cases of tuberculosis in a Massachusetts city of seventeen thousand souls, the deaths from tuberculosis were reduced 68 per cent, while in like neighboring towns, where no such extra effort was made, they fell only 32 per cent. In Cattaraugus County in New York State, selected for a "demonstration" by the Milbank Memorial Fund, the general death rate was reduced from 144 in 1923 to 126 in 1925, while the infant mortality rate was cut from 93 per thousand births to 65. Such achievements are practicable only with a public that has been extraordinarily stimulated and enlightened by intensive health propaganda. Daily news items, editorials, motion pictures, lectures, educational courses in the schools, exhibits, parades, magazines, bulletins, circulars, posters, advertisements, photographs, cartoons, and a host of other things are used for this purpose.

In the City of Syracuse, New York, another "demonstration" subject, the Bureau of Health Education places information and news on health subjects before every resident. For physicians and health workers, weekly bulletins set forth the mortality and morbidity records of the city with pertinent current information. For molders of opinion, such as clergymen, educators, club workers, and leaders in commercial

and social lines, there is published an illustrated magazine dealing with the work of the agencies in the demonstration and of other organizations in the city engaged in health activities. Editorials in the daily papers discussing the more important phases of health work appear at frequent intervals, and are of special interest to this particular group. The results of special surveys on child health, industrial health, and on venereal diseases, made by outside experts, have been published in pamphlet form and circulated among the technical people.

No serum does more for public health than printer's ink. To reach the general public, wide use is made of the newspapers. Articles are published to furnish health news, to give information and practical advice on health subjects, and to supply entertaining reading material. A series of weekly stories is built about an imaginary character, Mrs. Wise, who brings to the attention of her good neighbor, Mrs. Smith, certain truths that the department of health wishes to broadcast. There is also a series of illustrated health stories for children.

Advertisements are inserted from time to time in the local newspapers calling attention to some special feature of health work. These papers also issue special health numbers.

There is a speakers' bureau, and its handbook listing available speakers on health topics is sent to all clubs, churches, factories, and schools in the city. For large mass-meetings, national and state authorities on health topics are brought to the city. With the aid of motion-picture machines the bureau has been able to reach many foreign and native born American audiences to whom the unillustrated lecture does not appeal.

The children's health parade, now an annual spring event, illustrates all the health work being done for children in the city, and serves to drive home to a vast street audience the value of health work in the schools. Health talks told at bedtime are broadcast over the radio. Health literature of a popular nature is supplied to the various factory reading-rooms. In factories and large business houses extensive use has been made of news bulletins and pictorial posters. The public library sets out in a conspicuous place in its reading-room its special collection of books on health.

As a feature of the diphtheria immunization campaign, a contest is conducted in the public schools. A silver trophy cup is awarded to the school having the lowest percentage of diphtheria cases and the highest percentage of pupils to take the toxin-antitoxin preventive treatment.

All this arsenal of ingenious devices is available to any community that sets out to enlist the public in the promotion of its own health.

THE SPOILS OF HEALTH CRUSADES

There can be no question that organized systematic efforts to give the people the benefit of modern hygienic and medical knowledge have borne fruit. Along some lines in a single decade we now make greater advances in life preservation than formerly occurred in a thousand years.

In the words of an eminent public health official, "The yellow fever nightmare will terrify no more. There has been practically no cholera since 1873. Smallpox, which in former epidemics sometimes attacked half the population, is a negligible cause of death. Typhus fever is a very rare disease. Plague has not been able to gain a foothold . . . Typhoid fever is a vanishing disease. The diarrhoeal diseases caused four times as many deaths fifty years ago as now. Scarlet fever mortality has fallen ninety per cent. Diphtheria has decreased nearly as much, and the mortality from pulmonary tuberculosis has been cut in two."

LIFE TERMS, ANCIENT AND MODERN

If we divide the total of the years lived by those who die by the number of deaths, we arrive at the "expectation of life at birth." Now, the labors of Latin scholars have shown that the expectation of life in ancient Rome was very low as compared with today. Whereas in England at the age of fifteen the expectation of life for boys is forty-five years and for girls forty-eight years, in Rome it was twenty and fifteen years respectively. Whereas in England at the age of thirty the expectation of life for men is thirty-three and for women thirty-six years, in Rome it was nineteen and fourteen years respectively. Thorold Rogers tells us that in the Middle Ages the risks of death from disease were far greater than they are at present. Medical skill was almost non-existent, the conditions of life were eminently unwholesome, and the diet of the people for fully one-half of the year, though abundant, was insalubrious. "In the large towns the deaths, to judge from the returns up to the eighteenth century, greatly exceeded the births." In Geneva in the sixteenth century the expectation of life was fifteen and one-half years; in the seventeenth century, twenty-three and one-half years; in the eighteenth century, thirty-two and one-third years.

Writes Professor Irving Fisher,[1] ". . . During the seventeenth and eighteenth centuries in Europe human life was lengthening at the rate of about 5 years per century. During the first three-fourths of the nineteenth century, the rate was 9 years per century. During the last quarter it was 14 years per century; in Massachusetts, 17 years per century, and 27 years per century in Prussia in particular. More re-

1. American Journal of Public Health, January, 1927, Vol. XVII, p. 4.

cent data show that, in the first quarter of the twentieth century, for the United States, England and Germany, life lengthened at the amazing pace of 40 years per century."

THE LENGTHENING SPAN OF LIFE

Yellow fever and cholera have no longer a place in our mortality tables. In enlightened communities smallpox has become almost a curiosity. The death rate from diphtheria is hardly a quarter of what it was twenty-five years ago. Any city can be rid of typhoid fever. In 1890 the average death rate in the cities of the Registration Area of the United States was 22.1; the rural rate was 15.3. Now for this area the city rate is below the rural rate. In 1851 the death rate of New York City was 50; in 1925 it was 12.2, less than a fourth. For Massachusetts the expectation of life has risen as follows: 1855, 39.77 years; 1890, 43.48 years; 1895, 45.35 years; 1901, 47.75 years; 1910, 51.19 years; and 1920, 55.25 years.

On both sides of the Atlantic children born now may expect to live two decades longer than their grandfathers. In 1901 a baby born in our Registration Area might hope to last near 50 years. The expectation of life is now 59 or 60 years. No doubt five years could be added were the American people willing to lay out annually $2.50 per capita on well directed public health efforts instead of a paltry fifty cents. In Australia, in a period of 35.5 years, the expectation of life for men increased 12 years and that for women 12.5 years. In New Zealand the life span has reached 62 years, slightly better than in Australia. The Scandinavian peoples are a little ahead of us, while the English press us closely with a life expectation of about 55 years. Before the war, France, Germany, Italy, and Japan had life spans of 45 to 48 years. India with an expectation of life of 23 years is a bench-mark from which ascent can be measured.

Before the close of this century in some peoples the normal life may span the biblical "three score and ten." At its meeting in 1922 the American Public Health Association adopted a resolution that included the statement, "We, the health workers of our communities, are confident that there is nothing inherently impracticable or extravagant in the proposal we make that many nations may attain such knowledge of the laws of health, appropriate to each age and occupation, to each climate and race, that within the next fifty years as much as twenty years may be added to the expectancy of life (55 years) which now prevails throughout the United States . . . ."

THE BRIGHTENED SURVIVAL PROSPECT OF THE STUPIDS

One unanticipated result of socializing the blessings of medical and surgical advance has been the brightening of the survival prospect of the ignorant, the stupid, the careless and the very poor in comparison with those of the intelligent, the bright, the responsible and the thrifty. All elements have benefited by the policy of making health promotion a public utility, of course, but the socially less valuable elements have benefited the most. Fifty years ago the difference in prospect of growing up between the children of the wise and those of the foolish, between the offspring of the able and those of the incompetent, between the progeny of the prosperous and those of casual laborers, must have been much greater than it is today. Suppose we range the chief elements in the community in the order of their value to society. At the extreme left set the talented, at the extreme right place the pauper, defective and criminal stocks. Two generations ago the line defining the death rates of these elements would have tilted very steeply from right to left. Nowadays the mortality line has been brought down greatly, but most of all toward the right hand end of the scale, the result being that it approaches the horizontal.

So far as we can foresee, this making available to everybody the fruits of scientific medicine will continue. Thanks to charity and public policy, those too ignorant or careless to be competent custodians of their own health will, nevertheless, be protected at a hundred points from the chief enemies of human life.

DEATH NOT THE DISCRIMINATING AGENCY IT USED TO BE

So it is fair to conclude that henceforth death is to be by no means the discriminating agency it used to be before the public authorities and philanthropists set out to socialize health. The elimination process has been clamped down. Differential mortality can no longer be counted on to hold us up to the old standard of fitness. Great numbers are enabled to grow up and rear progeny who would have failed to get by the sterner tests of two generations ago—I mean persons of poor constitution, of feeble vitality, of low natural resistance to disease, the inheritors of sense defect or of mental defect or of weakness of character. I do not deplore this fading away of the differential in mortality. By all means let the gains of medical science accrue to all. But it is obvious that means must be found to substitute some other type of selection for the old relentless natural selection that prevailed until recently.

THE GROWTH OF DIFFERENTIAL FERTILITY

An English statistical expert, Sir William Beveridge, has shown that, in the thirty years, 1881-1911, the fertility of seventeen European countries that had in 1900 a population of 233 millions—nearly a sixth of mankind—declined more than a fifth. In the same period the baby crop of New Zealand and the Australian colonies fell off thirty per cent. In 1876 the birth-rate of England and Wales was as high as it has been since births began to be registered. In the course of the half century since 1876, it has been cut to just one-half. On the whole it is safe to say that annually two and one-half million fewer births occur in Europe than would occur if the birth rates of fifty years ago had been maintained.

In the United States we lack vital statistics reaching far back, but we know that the proportion of children under five years to women of child-bearing age was in 1920 less than three-quarters of what it was in 1880 and only half of what it was in 1820.

This decline is due not at all to lowered capacity to reproduce, but rather to the spread of birth control, which is now practised by perhaps fifteen per cent of the human race. I shall not enter into the pros and cons of birth control here, but wish simply to point out that it gives rise to what has come to be known as "the differential birth rate," which is as disgenic in its effects as the old differential death rate was eugenic.

Until the means of regulating the size of the family had been discovered, there is no reason to suppose that blockheads and intellectuals differed much in fertility. The professional and business classes differed appreciably from the handworkers in tendency to marry, but the wife of the Victorian lawyer or of the captain of industry was likely to bear about as many babies as the wife of the shoveller or of the factory hand. A recent study of the size of Chinese families made by Professor J. B. Griffing of the University of Nanking[2] shows no tendency whatever on the part of the college educated or highly cultured Chinese to have fewer children than the illiterate peasants in the rural villages.

What has happened in England has been set forth by the famous Dean of St. Paul's Cathedral, Dr. W. R. Inge:[3]

> "Until the decline began, large families were the rule in all classes. . . . . Since 1877 large families have become increasingly rare in the upper and middle classes, and among the skilled artisans. They are frequent in the thriftless ranks of unskilled labor, and in one section of well paid workmen—the miners. The highest death rates at present are in the mining districts and in the slums. The lowest are in some of the learned professions."

2. Journal of Heredity, September, 1926.
3. "Outspoken Essays," 1919, p. 70.

About 1910 a survey of England north of the Humber showed that "It is the less healthy parents, the men and women with the worse habits, and the fathers with the lowest wages, who have the largest families. Nor is this differential overcome by a selective death rate. The large industrial center Bradford furnishes data which show that "at all ages the parents with bad habits had more children alive than the parents with good habits." The report sees the prolific unfit as a "swamp that is threatening to rise and engulf the nation."

In England and Wales in 1911 there were 119 births per thousand married males under fifty-five years of age in the upper and middle class, 153 among skilled workmen, and 213 among unskilled workmen. After allowing for unequal infant mortality rates, the babies surviving the first year in the three classes would be as 110, 136, 181. It is interesting to observe that while solicitors, physicians, and Church of England clergymen had about 100 births a year, costers and hawkers had 175, earthenware workers 181, and dock laborers 231.

Taking as an index of fertility births in relation to wives of child-bearing age, then, if the fertility of the general population be 100, the coal miners score 126.4, the agricultural laborers 113.4, while the professional people score 65-80.

An investigation in London showed that in 100 families from which normal school children came there had been 506 births, 387 children being then alive. In 100 families from which came feeble minded children enrolled in the special schools for such children, there had been 761 births and 465 children were still alive. Thus it appears that sub-normal couples lack the intelligence or motives for controlling the size of the family that normal couples manifest.

CLASS FERTILITY IN AMERICA

We have no such knowledge of class fertilities within the American people as has been secured for the smaller and more compact population of Britain. On this matter the most illuminating ray of light comes from the federal annual report on "Births, Stillbirths, and Infant Mortality Statistics." From a 1923 report it appears that in families in which the birth of a child was registered in 1923, the number of living children averaged 5.45 for fathers 50-54 years of age who were bootblacks, boiler-washers, engine hostlers, longshoremen, stevedores, draymen, teamsters, coal mine operatives and common laborers. But the number of living children averaged only 3.54 for fathers of the same age group who were engineers, teachers, physicians, lawyers, judges, inventors, dentists, clergymen, chemists, authors, newspapermen, architects, bankers and railway officials. This means about two more children left by handworkers than by brainworkers, by

unskilled laborers than by men of the learned professions, by the privates in the industrial organization than by the officers.

From the same tables, Pearl calculates[4] the relative fertility of the American occupational groups in which the father was above forty-five years of age to be as follows:

1. Professional service 1.00
2. Clerical occupations 1.02
3. Trade 1.23
4. Domestic and personal service 1.27
5. Public service 1.31
6. Transportation 1.44
7. Manufacturing and mechanical industries 1.58
8. Agriculture forestry, and animal husbandry 1.65
9. Extraction of minerals 1.90

He concludes: "In our population it appears that the professional, clerical, trade, domestic and personal service, public service, and transportation occupational classes are reproducing themselves in such manner as to maintain about in its present status their relative representation in the population. But the heavy laboring classes, manufacturing, agriculture, and mining, are reproducing themselves greatly in excess of their representation in the population."

It will generally be conceded that college graduates come from a socially valuable element; my own opinion is that they are drawn from the brightest twenty per cent of the population. Now we have abundant data which show that of the graduates of women's colleges only about half marry, and they produce less than three children per couple. Of the graduates of men's colleges about three-quarters marry and become fathers of from two to two and one-fourth children each.

Cattell has found that of the thousand most eminent American men of science, nearly ninety per cent marry, yet beget on the average only 1.88 children. "A scientific man," says Cattell, "has on the average about seven-tenths of an adult son. If three-fourths of his sons and grandsons marry and their families continue to be of the same size, a thousand scientific men will leave about 350 grandsons to marry and transmit their names and their hereditary traits. The extermination will be still more rapid in female lines." Yet we know that the sons of such men are at least fifty times as likely to achieve eminence as the sons of the first man you meet on the street.

4. American Journal of Hygiene, July, 1926.

FERTILITY AMONG IMMIGRANTS

It is aside from my present purpose to show how our germ plasm has been modified for all time by the great tides of immigration into this country. I do wish, however, to bring out two tendencies. One is that the newcomers rarely practise birth control; that for the decade 1910-1920 the foreign-born in this country were 1.6 times as prolific as the native-white. This results in displacement. The other is that the children of the immigrant born in this country on the whole have much smaller families than their parents have; but the drop in fertility is very unequal. The bright and ambitious become quite Americanized and have families of even less than American size; whereas the low grade inherit the dull peasantism of their parents and produce children at the Old World rate.

I conclude that in its earlier stages of dissemination the practice of family limitation is highly dysgenic. When many of the alert, the forelooking and the wide-considering stint their increase, whereas all the stupid, the superstitious and the wife-killing males procreate heedlessly, birth control takes the brains out of the race at an alarming rate. But at a later stage, when knowledge of family limitation methods has become nearly common property among the married, the outlook is not so dark. For the giddy and the selfish will plume themselves on their shrewdness in rearing but one or two children, while the responsible, the conscientious and the noble will go on to rear a real family.

In my judgment our state and federal laws classing contraceptive information as "obscene," and forbidding under heavy penalties not only its circulation through the mails but even its communication by word of mouth, have practically no effect in keeping such information from the bright aspiring and successful elements of the population, but they do hold it away from many of the poor, the ignorant and the overburdened—just the element least able to rear capably a large family and presumably possessing least in the way of hereditary gifts to pass on to their children. Let the man-made obstacles to the circulation of contraceptive information be cleared away so that couples who find themselves bringing into the world weaklings and defectives shall be enabled to cease committing a crime against society.

RACE DETERIORATION AND DESTRUCTION WITH SPECIAL REFERENCE TO THE AMERICAN PEOPLE

ALES HRDLICKA, Curator Division of Physical Anthropology, United States National Museum, Smithsonian Institution

By *deterioration* of a race we understand the degradation of its standards of mentality and effectiveness, generally attended also by the lowering of those of physique. *Destruction* of a race means the loss of its identity through complete submergence into another race; or, extinction through death.

Human groups may deteriorate either through internal causes—that is, factors originating in the group-organism itself—or through external agencies. The *internal* factors are all those that lastingly enfeeble or derange the sound heredity of the group. In animals the most common of such causes are prolonged inbreeding, breeding with inferior stock, the weeding out of the best, the preservation and breeding of the less fit, affection of progeny through prevalent infections, and idleness. Much the same agencies, with similar results, must act in man. As to the *external* unfavorable factors in man, they comprise disease, war, untoward lasting changes in climate, overwork, poisons. They, too, act similarly in organic beings in general and in the human kind, but in man they are supplemented by all such mental effects as favor depression and demoralization. Destruction of a stock is mostly but the ultimate stage of deterioration and has the same reasons.

THE RISE AND DECLINE OF NATIONAL GROUPS

Since the dawn of human history, many a human group has flared up to an acme of power and culture, remained at the top for shorter or longer periods, and then invariably gone down, while new groups were forging into prominence. There was no exception, which would suggest that the phenomenon is a general rule and may obey, in addition to the above named causes, some deep-seated law.

The units affected—the Egyptians, Sumerians, Babylonians, Assyrians, Persians, Phoenicians, Greeks, Romans, Jews, Moors, Huns, Mongols, Aztecs, Incas, etc., were neither whole racial groups nor always pure—they were rather political and linguistic, or *nationalistic,* groups, and while they were surging or receding, other parts of the same race were unaffected. And there was no apparent racial regularity or sequence in the process, the causes being essentially geographical, economical, cultural and personal. The motive powers of the rise and fall of nations are therefore evidently not inherently or solely racial.

Just what they were in each case is not easy to determine, for there is no true and complete history of any people. But in general the courses of events were apparently so similar that some generalizations may be possible.

In each case the beginning of the rise shows a fresh, virile, morally strong, and already numerous group, led by ambition and an able leader, and enthused by some great ideas, of conquest, power, riches, religion. The sequence of events is then, successful wars, continued extension of domain, increase in opulence of the leading classes, development of military and religious heirarchies, forcible attachment of unwilling peoples and continued loss of the most virile and able in wars and colonial administration. Then sets in luxury, idleness, weakening of discipline and morale; there are neglect and ignorance of the masses, slavery and admixture with lower or weaker groups; to be followed by dynastic troubles, revolutions, epidemics of disease, growing enfeeblement of the whole structure, increasing failures in war, and eventually invasions by "barbarians," conquest, destruction of culture, pillage, followed by demoralization and poverty, with finally more or less continued weakness and dormant condition.

FACTORS OF FAILURE

When these factors are weighed, it is found that those of the foremost apparent importance are lack of able leaders, especially on critical occasions; an exhaustion of ambition through the attainment of the original material aims; and a general enfeeblement of morals and forces through growing luxury and indolence, with a simultaneous weakening of the structure of the state through unassimilated conquered peoples. To this may be added in some cases a dilution of the physical as well as mental status by admixture with poorer blood, brought in through slaves and mercenaries. Combine with this the fact that the power as well as the culture of every one of these older torch-bearing groups was limited to the few while the masses were kept in ignorance and oppressive subjection, and there are the visible conditions of the past human failures.

Whether besides this there is in nations and races also something akin to a natural life-cycle similar to that of an individual, with its youth, a full-blown stage and then a more or less rapid decline and enfeebled old age, it is difficult to say, though not a little would seem to favor some such assumption.

A complete destruction of a racial group, however, appears, whatever its fate has been otherwise, to be next to impossible. Disappearance, yes. Most of the old groups are gone as such. But their blood remains, in spots even pure, though mostly mixed and obscured by

newer aggregations. There are to this day remnants of pure old Egyptians, Greeks, Assyrians, Mongols, Mayas, and all the other once dominant "races;" but the great majority are now a mixture of the old with whatever came later. They are inextricably submerged, but not truly annihilated. The American Indian here and there, the Polynesian, the semi-mongolic tribes of Russia and Siberia, are going, but largely through admixture. Even the Australian is leaving a trail of mix-bloods behind him. Only such small groups as the Tasmanians, the Hottentots and the South African Bushmen have gone or are going out entirely. They were too small in numbers, possessed too little immunity against introduced disease, and were too undesirable for mixture—to survive.

ADVANTAGEOUS AND DISADVANTAGEOUS RACIAL MIXTURES

Mixture of peoples, of itself, is not necessarily a bad factor. Much depends on its nature and circumstances. A mixture of healthly individuals belonging to the same general human stock, such as the white, is not, so far as science can determine today, detrimental, and may possibly be stimulative and therefore of advantage. There is no larger group of white people existing today that is not more or less admixed, and none, including the American, that would show any perceptible deterioration or weakness from that condition alone.

But a mixture with a definitely poorer stock, physically or mentally, could not possibly be beneficial, or harmless. If there is added ninety to one hundred, the mean result will surely be less than one hundred; and the defect may be further enhanced by a poor treatment of the result, a poor bringing up of the child. This touches intimately on the problem of the mixture of the American white with the American negro. There are still some benevolent minds who would like to see all men, white and black, potentially equal. Yet they will hold that there are differences between one family and another family, and even between the children of the same family, in the same racial group. If they did not, there would obviously be no use for eugenics, no use for this or any similar Conference, no use even for much of genetics and biology. As a matter of fact there are similarities but no absolute equality anywhere in living nature, either in races, or families or even individuals. The problem is merely how great in a given case is the dissimilarity. Races, especially the further distant ones like the white and the negro, if the accumulated observations of anthropology count for anything, are not equipotential, or equally effective, or able, or resistant, and the results of their union will be the strengthening of the weaker, as seen in many of our mulattoes, but the weakening of the stronger constituent.

A DANGER TO THE AMERICAN PEOPLE

This is touching the one great sore spot in American anthropology. A probable, if not inevitable, assimilation of the colored population into the white is the one real cause of anxiety to those who contemplate the future of the American people. As long as the colored tenth is held apart, there is no danger. The limited influx of white into the colored blood is a gain to the latter. The danger lies in the colored stream flowing eventually wholly into the body of the larger white group. If this should happen, some change in the white body would be inevitable, and it would be a bold scientist who could argue that such an event might be beneficial.

This, as anthropology sees it, is the one cloud on the otherwise clear and blue sky of the American people of the future.

BIOLOGICAL ADVANTAGES OF SELECTED IMMIGRATION

In the past fifteen years have been heard many alarms of threatening deterioration of the American stock through the influx of the so-called "inferior races" of white derivation. These threats have received no scientific foundation. They were and are being bolstered up by pseudo-science only. Their true background is economic, supplemented by the universal trait of national or group egoism.

There is no proof that the normal white immigrant, of any source, has lowered the physical or mental standards of the American people, or would threaten their deterioration. Differences there are, and their total resultant differs doubtless from group to group, but the mean group values within the white race are evidently not yet far apart. The indications are, moreover, that the immigrant in this country does not degenerate but rapidly improves; and his admixture, like that of a new stock in the various domesticated species, may be in general of biological advantage rather than a danger.

Anthropologists would surely be grateful if in the Press, before the Congress, and elsewhere, the true reasons for the restriction of immigration were candidly faced and an end were put to the camouflage of "race deterioration."

A BIOLOGIC PHILOSOPHY OR RELIGION A NECESSARY FOUNDATION FOR RACE BETTERMENT

Dr. Aldred Scott Warthin, President of the National Association of Physicians; Director of the Pathological Laboratory, University of Michigan.

One listens to the papers of this Conference with mixed feelings. On the one hand, we hear of wonderful human life extension. On the other hand, we hear of failure of the best class of people to bring progeny into the world. From all of this, one might really wonder if we are not at a race deterioration rather than at a Race Betterment Conference, for neither one of those factors can be regarded as in itself meaning Race Betterment.

We hear of the possible extension of the limit of human life into the eighties, to a hundred, and over, but not very much is said about the value of those who live to these advanced ages and what good it is to the human race if that value is not an increased one. If these lives have a value below par, what is the use of saving them? What is the use of their extension? We are quite sure in our own minds that there are a good many people living now who ought to have passed away; we cannot feel that their continued existence upon the earth is worth while. Moreover, when we are told that our best people are refusing to have children, and that the children who are going to be made to live so long, to one hundred years or more, are the children of inferior classes, again we are disturbed in mind, we are worried. The trouble is we have begun at the wrong end. It is true that both of these facts that I have just stated are facts that stand for race deterioration when they are considered in themselves alone.

Now, I think that what we need is a new religion, a new philosophy of life, one that is based upon what we know of life, what we know of the human body and what we know of the virtues. Man's religions are only his reactions to environment anyway. They have always changed with his environment. New philosophies and new theologies arise from man's attempt to adjust himself to his environment, to adjust himself to the Universe. Has not the time come, then, for us to begin at the proper end, if we mean Race Betterment, and that is to have our living human beings, young people, come to believe that life upon this earth is the most important thing after all, that our biologic function is reproduction, and the reproduction of individuals of a high character, of high quality, of par value or above par, not below?

THE GERM PLASM IS THE IMPORTANT THING

How is this going to be brought about? We may say that we are educating the people as a whole in regard to these facts, but how little education has been accomplished. In the last twenty-five years how little the medical profession has done with its knowledge of heredity! In fact, the medical profession as a whole has constantly opposed heredity, particularly with regard to the etiology of cancer or carcinoma. The facts of the situation have long been known to medicine, but it has not been until really the last ten or fifteen years that a new medical philosophy has arisen. Medicine is just beginning to realize that the individual's germ plasm, the individual's protoplasm, is the important thing, that the reactions of each individual are different and that disease is simply the individual reaction to external environment.

And we know today that the race about us is not free and equal. If we accept the opening line of the Declaration of Independence as a biologic fact, no greater untruth was ever stated. We are not created free and equal. All of us have different protoplasmic values. Some of these values are high, some mediocre, and many of them are very low. The physician in practice must take cognizance of these variations in protoplasmic values. There can be no real medicine that does not consider the germ plasm, that does not consider the hereditary constitution of the individual as the important thing. Our treatment, our diagnosis of disease, must be based upon those various facts.

THE "DIVINITY" OF EVOLUTION

What is life? What do we know about it? We know that life is a combination of energy and matter. It is identical with the energy and matter of the whole Universe. There is entity of energy and matter that has shown itself in what we call the inanimate world, the so-called elements, the only difference being rates of speed, differences in motion probably. At a certain time in this Universe these combinations of energy and matter reached such a point that energy could be gathered up, stored up, and released by a chemical physical combination. That chemical physical combination was life beginning in a very simple form, at some unknown time. Millions and millions of years ago upon this earth that simple cell combination, a physical chemical combination, began to build up. By this ability to build up from the chemical physical standpoint it became, I may say, endowed with a divine power. If there is anything divine in this Universe, it is the ability of protoplasm to rise above its surroundings, and that is the characteristic of the animate world.

Now, through the millions of years that followed, because of that divine ability to add chemical molecules, to build up a chemical physical

combination and rise above environment, the various forms of life came into existence, one after another. Evolution was a necessity if life persisted. It was an absolute necessity, and we cannot deny now the facts of evolution. It does not matter how that evolution took place. It is trivial, childish to consider such things as whether your ancestor at one time was ape-like or not. That has nothing to do with the question, with any mind that can think at all. What is important, I think, is for the young individual who is now brought into this world to follow that knowledge of evolution and to realize that with changing environment the germ plasm can change and does change.

I believe absolutely in the acquisition of qualities by the germ plasm; I believe absolutely in the transmission of acquired qualities. There could have been no evolution without it. Accepting those facts, I think we have the basis for a very definite religion of life, a definite philosophy of life.

BIOLOGIC SIN

If I speak of a religion of life, I must, I suppose, use certain old terms, theological terms. I would like to speak of biological sin or sins. Anything that would terminate the line of germ plasm, which has culminated in you as an individual, must then necessitate the greatest biologic sin. In other words, our biologic mission is to carry on this immortal stream of germ plasm, life.

Any man or any woman, whose family history is good and whose health is good, who does not procreate, who does not bring into the world an individual just as good as, maybe better than the parents, has committed, I think, the unpardonable sin—biologically. Reproduction is the aim of our existence. That is the first law. The second law would be to make our progeny better than ourselves—in this way to keep up evolution and in this way to drive out the unfit, to supplant them, replace them by people who are fit to live to one hundred years or to one hundred and twenty-five years or more, and to enjoy this longer life.

Many factors militate against acceptance of such a thing. It is difficult to shed old religions. It is difficult to shed old superstitions, to do away with old faiths. But many of those old faiths have done a tremendous amount of harm in this world. The doctrine of the forgiveness of sins has done more harm, biologically, than almost any other thing in the human race. You may speak of the forgiveness of sins in a spiritual way, but forgiveness has never been taken by the human race in that way. And can the forgiveness of sin remove the spirochaete from the body of the individual who has syphilis? Never. The spirochaete goes on in that body to the end of that man's existence, no matter how spiritual he may be, or how refined or purified, even feeling

that his sins have been forgiven. Can the forgiveness of sins remove the gonococcus from the fallopian tube of the young woman? It cannot, and, as a result, thousands and thousands of young women, in this country, are sterilized because of gonococcal salpingitis. Can the forgiveness of sins remove the blastophthoria produced by alcoholism in the father or mother particularly at the time of procreation?

SENTIMENTALISMS THAT MAKE FOR RACE DETERIORATION

Then we must go still further with forgiveness of sins. There are many sentimental emotional factors in the human race that make for race deterioration. Take many of the old novels. You remember how often the hero or heroine had typhoid fever, was on the bed with acute infection and was going to be married or was married as soon as it was possible to stand up, and how many times procreation took place with these individuals within the given time. Who today would encourage procreation in the weeks or even months following an attack of typhoid fever because we know that there is such as thing as typhoid blastophthoria, that there is such a thing as pneumonia blastophthoria, that the germ cells are often killed for some weeks or months after attacks of severe infection. When they are not wholly killed but are still capable of procreation, what is the product of procreation of an individual suffering from intoxications of various sorts? We see many things in pathology that may be explained in this way. Old faiths, old superstitions, old beliefs, old emotions must then pass away, in order that we may explain these by a new faith, by a new biology.

Old religions are dying. There is no doubt about that. I am in intimate contact with young men, with medical students, and I know that the great majority of these students have thrown off old beliefs and that they are looking for something to supplant them. They are looking for something that is logical, reasonable, rational, material upon which they can found their beliefs in life.

And I have experienced the fact that, to many of these, simple biology, the simple facts of life, can become an adequate philosophy, an adequate religion, whereby they alter their habits, they alter their lives, they plan their lives, they develop their ideals.

OUR DUTY TO THE IMMORTAL GERM PLASM

And for what purpose? That they may make the best of themselves, of their spirit, soul. They want to marry, and not from the old sex traditions. They will study the family history. They want to get into a family where there is no insanity, and none of the incurable forms of disease. They want the best partner that they can get and in getting this best partner, they want to have children that they can make better than themselves.

I think that is the whole story of life. It is a sufficient philosophy, it is a sufficient religion. We must act upon the knowledge that science has given us up to the present time. We do not need to worry about the immortality of the individual. We know that life is immortal, that in our bodies there is an immortal germ plasm which we are protecting. We can damage it, and therefore we must take care; it is our duty to pass it on unchanged.

I hope that no one will think that I am in any way iconoclastic or that I have spoken disrespectfully in any way of any existing religion, but if the human race is to go on as it should, without deterioration, I think that these are the facts that must animate our lives.

TRIAL MARRIAGE WOULD DAMAGE THE RACE

Just one word as to marriage. My students always come back with that one thing. What about marriage? Marriage is a sex partnership for a definite end, and that end should be made possible by us. I cannot believe that trial marriages are anything but degenerating and deteriorating. They will damage the race more than anything else. A proper marriage is marriage that must last at least twenty-five years, if you are going to bring up one child successfully. The human child needs parents, a father, a mother, for at least twenty-five years. It needs the counsel of the older people, to offset the emotions of adolescence.

In closing, I believe that all that is needed for a satisfactory and practical philosophy of life is just, in short, this thing: Make the most of yourself. Get the best sex partner you can, one with whom you can join your body to bring into this world children that you will make better than yourselves.

THE PRACTICAL APPLICATION OF EUGENIC PRINCIPLES

LUTHER S. WEST, PH.D., Professor of Biology and Eugenics, Battle Creek College; Chairman Local Committee for the Fitter Families Contest

The general aim of the American Eugenics Society, Inc., is to forward the practical application of eugenic principles to the improvement of the American population. The means for accomplishing this aim comprise the promotion of eugenic research, eugenic education, conservative eugenic legislation, and eugenic administration.

Most fundamental of these is eugenic research, and much remains to be accomplished in this field. Certain tendencies, however, are so definitely understood, as results of our present genetic and sociological researches show, that constant effort in the direction of eugenics education is not only justified but much to be desired. Under eugenics education we may distinguish formal or scholastic education through schools and colleges, consisting largely of the introduction into the curricula of courses dealing with genetics, eugenics, etc., and popular education, through the press and by such other means as will stimulate public interest in matters pertaining to human inheritance. It is in this last category that the Fitter Families Contest falls. Too much cannot be said in favor of a conservative sort of popular education work along these lines, for the percentage of citizens who are so fortunate as to secure formal instruction in college or elsewhere is exceedingly small compared with the number of people who ought to know the value of eugenics in relation to the future of the race.

The Fitter Families Contest represents an outgrowth of the Better Babies movement. It was originated some years ago by Mrs. Mary T. Watts who, until the time of her death, served as Chairman of the Popular Education Committee of the American Eugenics Society. The movement originated at a state fair. Mrs. Watts' most interested adviser from the beginning was Dr. Florence Brown Sherbon, Director of the Bureau of Child Research, University of Kansas, Lawrence, Kansas. These baby contests were remarkably successful in stimulating public interest, and certainly they accomplished far-reaching results in the field of health education. It is now difficult to find any agricultural affair of importance at which there is not some kind of health examination or health contest carried on.

WHY THE GENEALOGICAL DERIVATION IS IMPORTANT

Dr. Charles B. Davenport, Director of the Eugenics Record Office, Cold Spring Harbor, Long Island, was instrumental in urging Mrs. Watts to extend the scope of her activities to include all members of the family. Dr. Davenport's statement has become famous in the history of this work: "A prize-winner at two may be an epileptic at ten." It is necessary, of course, to take into account the genealogical derivation of an individual as well as his own individual mental and physical equipment in determining his ultimate fitness for citizenship and for parenthood. It was eight years ago that the Fitter Families Contest replaced the Better Babies contest as an educational feature. The plan is explained by Dr. Sherbon as follows: "The Fitter Families Contest is to be regarded merely as an extension of scientific plant and animal husbandry to the next higher order of creation. It is not our intention to draw any more line between heredity and environment than is drawn by the stock judge when he examines animals and takes into consideration the heredity, feeding and the care of the product."

RURAL DISTRICTS FURNISH 88 PER CENT OF TOTAL POPULATION IN FOUR GENERATIONS

To date the Fitter Families Contests have been confined largely to state fairs, which occasions afford excellent opportunity for carrying on such enterprises. There are at least two reasons for the success of these contests: (1) At such gatherings there are assembled large numbers of individuals much interested in problems of heredity and nurture because of their experience as plant and animal breeders. To them it seems most logical to extend the same principles to the human organism and to inquire into the relative value of these factors in determining the fitness of human stock. (2) Families attending fairs, having left their business or agricultural enterprise, are enjoying a few days of comparative leisure and can well afford the time necessary for the examinations required as part of the Contest. There is also another excellent reason why the agricultural exposition will still continue to be a most fertile ground for this type of educational work. According to our census, rural districts supply a disproportionately large part of the future population. It is estimated that in four generations, the 50 per cent of the present population that is rural tends to become 88 per cent of the total stock. It is exceedingly to be desired, therefore, that we secure all possible data relative to the general fitness of our agricultural populations. The results, if sufficiently general, would go far toward indicating the evolutionary tendencies of our race.

COOPERATING ORGANIZATIONS

The number of organizations whose work has to do directly or indirectly with the aims of the Eugenics Society is very large. Among these are The Eugenics Research Association, The American Genetic Association, The Race Betterment Foundation, The Carnegie Institution of Washington, The United States Census Office, The United States Department of Agriculture, The State Agricultural Experiment Stations, The United States Children's Bureau, The United States Women's Bureau, The United States Immigration Bureau, The United States Indian Bureau, The University of Iowa Child Welfare Bureau, The Station of Juvenile Research, Whittier, Calif., The Psychopathic Laboratories in Municipal Courts of Chicago, Detroit and various other cities, The American Law Institute, Washington, D. C., the departments of biology, psychology, anthropology, medicine, sociology in all universities, Stanford University investigating "gifted youths," The Family Records Committee of the National Research Council, the State Board of Public Affairs (cf., Wisconsin Mental Deficiency Survey), Daughters of the American Revolution, Daughters of the Confederacy, Daughters of 1812, Sons of the American Revolution, lodges, hospitals, colonies for epileptics and feeble minded, sanatoria, dispensaries.

THE RACE BETTERMENT FOUNDATION

The Race Betterment Foundation as an individual enterprise may well be listed as very important in this group. It is felt by those more or less closely connected with the organization that the Race Betterment Foundation will ultimately find its best work in the field of eugenics education, its accomplishments to date being largely in that direction. Battle Creek College, with a present enrollment of approximately 650, is quite properly to be considered a child of the Race Betterment Foundation. I believe it is the only collegiate institution specifically dedicated to Race Betterment, and as the number of its graduates increases, the influence of the institution in all aspects of Race Betterment work is certain to become considerable.

THE PHYSICAL AND MENTAL PERFECTION CONTEST

The first striking enterprise of the Race Betterment Foundation was the promotion of the First Race Betterment Conference held in 1914 at Battle Creek, mentioned at this point because of the fact that a very important feature of that Conference was a Physical and Mental Perfection Contest held in connection with the Conference. This demonstration involved the examination of a large number of children of school age with distribution of prizes to individuals of outstanding excellence. For a full report of this Contest see the Proceedings of the First Race Betterment Conference. The Second Race Betterment

Conference held in San Francisco at the time of the Exposition did not afford opportunity for a demonstration of this kind.

During the interval between the First and Third Conferences (first, 1914; third, 1928), the Fitter Families Contest idea had come into being and was well established, as indicated in the preceding paragraph. It was, therefore, quite natural that Dr. John Harvey Kellogg, President of the Race Betterment Foundation, in organizing the Third Race Betterment Conference, should invite Dr. Florence B. Sherbon and Mr. Leon F. Whitney, Executive Secretary of the American Eugenics Society, to conduct a Fitter Families Contest in connection with the Conference, utilizing the machinery and methods already employed by the American Eugenics Society in their work. The writer was appointed Chairman of the local committee, which included the following prominent citizens: Mr. and Mrs. Irving Stone, Mr. and Mrs. Fred Gage, Mrs. L. S. West, Mr. and Mrs. Rudolph Habermann, Mr. and Mrs. B. S. Eppes, Mr. and Mrs. H. C. Hawk, Mr. and Mrs. George Dolliver, Mr. and Mrs. A. L. Miller, Rev. and Mrs. W. G. Studwell, Mr. Frank Evans, Mr. James Foy, Father Dillon, Mr. and Mrs. Robert Tomson, Mrs. Winifred Harvey, Mr. and Mrs. James F. O'Brien, Mr. and Mrs. W. J. Smith, Mr. and Mrs. W. G. Coburn, Dr. and Mrs. E. L. Eggleston and Mr. and Mrs. M. W. Wentworth. It was the particular duty of the local committee to arrange in advance that a number of desirable families should pledge themselves to participate in the Contest, and also to provide and organize the necessary facilities for carrying out all phases of the examination work.

THE PRACTICAL PROCEDURE

In carrying out contests under such circumstances as prevail at state or county fairs, it is necessary to arrange much in advance. Usually one or more large tents must be set up and provided with booths, and it is necessary to recruit the examining staff from the nearby town or city, the specialists in the fields of psychiatry, psychometric analysis, genealogy, etc., frequently being imported from some college or university nearby. This organization involves some expense and a good deal of worry and is not always highly satisfactory, due to lack of the best facilities.

It was not only necessary but desirable to modify this scheme somewhat in order to take advantage of the local conditions existing at the Race Betterment Conference. The Medical Staff of Battle Creek Sanitarium includes a large number of specialists in all fields, while the faculty of Battle Creek College was in an excellent position to furnish cooperating specialists in several phases of the work. A list of the physicians and others who gave considerable time and energy to this

enterprise is given below. Each individual is listed under the department in which he served:

EUGENICS	STRUCTURAL	DENTAL
Dr. Florence B. Sherbon	Mr. Leroy F. Sparks	Dr. R. M. Kellogg
Mr. Leon F. Whitney	Miss Jessie Cameron	
Dr. Luther S. West		
SOCIAL	**MEDICAL**	**SPECIAL SENSES**
Mr. Ayres Raymond	Dr. Estella G. Norman	Dr. C. W. Heald
	Dr. E. P. Russell	Dr. R. H. Fraser
PSYCHOMETRIC	Dr. L. A. Tarbell	Dr. Carl G. Wencke
	Dr. J. E. Cooper	
Mr. B. F. Birkbeck	Dr. J. R. Jeffrey	
Miss Lorna Barber	Dr. Zelma McManus	
PSYCHIATRIC	**LABORATORY**	**HEALTH HABITS**
		Dr. Helen S. Mitchell
Dr. M. J. Gilfillan	Dr. Paul Roth	Miss Lola Schmidt
	Dr. C. E. Roderick	Miss Margery Vaughn

The number of participants in the Contest was approximately 125, included in 30 families. Had there been more time, it would have been possible to handle a much larger number. Several families applied too late to be admitted. Of the total number of participants there were 29 individual awards, representing about 20 per cent of the total number of entries. The requirements for an individual award are explained further on. Examinations continued over a period of four days. The time required for a complete examination of an adult individual was approximately three and one-half hours. This will give some idea of the degree of thoroughness of the examination itself. Some of the tests were omitted in the case of the children, and in some cases it was impossible to secure a complete record because of lack of time. However, the records are fairly complete taken as a whole, and the results are reasonably accurate. The individuals were ushered from one specialist to the next as rapidly as possible, the order of examination being usually that indicated in the preceding list of departments.

METHODS OF SCORING

There is reproduced herewith a sample data or score sheet such as is employed for Fitter Families Contests. Whereas it would be desirable to secure more data than this for each individual, the time available for examination renders this practically impossible. Improvement in the method of scoring will undoubtedly be forthcoming as a

result of the research project which is discussed later in this paper. The sample score-sheet here shown is for the examination of an adult female. A similar score card appropriately modified is used for adult males. The same form is employed for recording data on children, but infants are scored on a different basis.

It will be noted that only nine departments are indicated on this score card. The tenth, or more properly speaking the first, being that which relates to the individual's genealogy. Some explanation is in order concerning this particular phase of the work. The form employed for recording genealogical data is the so-called Abridged Record of Family Traits long used by the Eugenics Society for the compiling of such data. Whereas it would be more desirable to utilize the unabridged record, especially if the data are to be of ultimate value to the research genealogists, it has been found that the amount of information available at the time of the examination rarely exceeds that which can be recorded on the abridged record sheets, and furthermore that the data so recorded are altogether adequate for estimating a eugenic score. In other words, for the purposes of the Contest, this type of record is sufficient.

Detailed material is recorded for the father's father, mother's father, father's mother, mother's mother, father, mother and each child in order. For the parents of the father and mother, the following information is obtained: full name (in case of female, full maiden name), approximate year of birth, birthplace, principal residence, number of sons and daughters who grew up, occupations at successive ages, any history of disease, cause of death if known, special tastes, gifts or peculiarities of mind or body. For the parents themselves: full name, year of birth, birthplace, education, favorite studies or pursuits, residences, age at marriage, total number of sons and daughters, ages of sons and daughters who died early, occupations at successive ages, illnesses in youth and middle age, surgical operations undergone, if dead cause and age at death, if blood relative of wife or husband, and what tastes, gifts or peculiarities of mind or body. For children: full name, date of birth, birthplace, education, principal residences, if married, to whom, year of marriage, number of children, occupations at successive ages, diseases to which liable, if dead age at and cause of death, special gifts or peculiarities of mind or body, character, favorite studies, pursuits, amusements. Space is given for recording the following information concerning any other relative on which data are available: surname, given name, place in pedigree (relationship to father or mother), approximate year of birth, if dead year of death, cause of

death, to whom married, number of sons and daughters, diseases or defects, occupation, any special gift or striking quality of mind or body. This applies to first cousins, uncles, aunts, great-grandparents, etc.

In this, as in other phases of the examination, the score is indicated by a letter A for excellence and superiority, B for good, high average, no obvious defects, C for medium, no serious defects, D for poor. Plus or minus signs are employed to indicate lesser differences. Thus much depends upon the ability of the reviewer to render a fair score. This Contest was fortunate in having the services of excellent individuals for this work. In judging the genealogical data, greater emphasis is placed upon the intellectual accomplishments of the various individuals recorded in the genealogy than on the health record, it being assumed that physical inferiority or superiority of a family may be more accurately measured by that portion of the examination headed "Medical" than by the somewhat second-hand information that the genealogy will furnish. Intellectual superiority, however, as demonstrated by business success, leadership, etc., is quite dependably shown by the information that the abridged records furnish. In judging a family's eugenic score, it becomes necessary to estimate first the eugenic score of each of the several individuals and then to average the results. Hence the father's side of the house might score higher genetically than the mother's side. The father's eugenic score would, therefore, be higher than the mother's. The children's eugenic score would be represented by an average of the two.

A very logical criticism of this method of determining an individual's fitness for parenthood may be made on the grounds that it provides no way of arriving at the actual genetic constitution of the individual. Two brothers with precisely the same eugenic score may carry in their germ plasm very diverse traits, for reasons well known to the geneticist. But we have no method of determining the genetic constitution of plants or animals, for that matter, except by a breeding-test, and we may therefore satisfy ourselves with the realization that we are making as close an evaluation of the probable genetic constitution as is humanly possible.

DATA SHEETS

TABLE I

COMPOSITE TABULATION OF ALL SCORES

	Age	Eugenic	Social	Psychometric	Psychiatric	Structural	Medical	Laboratory	Dental	Special Senses	Health Habits	Total Ind. Score	Ind. Awards
Entry No. 1—													
Female.....	33	A	C+	A	A	B+	B+	B+	D	A	B	B+	
Female.....	43 mo.	A	B		A	B					A	B	
Male.....	26 mo.	A	B+		B	B	A				B	B+	M
Male.....	4 mo.	A	A		A	B	B				A	A	M
Family Score: B+													
Entry No. 2—													
Male.....	58	B+	B+	C+								Inc.	
Female.....	55	B+	B+	B	A	B—	B—	B	B	A	B	B+	
Male.....	30	B+	B+	A	A	B—	A	B	B+	B	B—	B+	
Male.....	28	B+	A—	C+	A	C+	A	C	B	A—	B	B+	
Male.....	21	B+	B	A	A	B	A	B	B	A	B	B+	M
Male.....	14	B+	B	B	A	B	B	B	B+	A	A	B+	M
Family Score: B+													
Entry No. 3—													
Male.....	42	B	B+	A	A	B	B	B—	B+	B	A—	B+	
Female.....	41	B	B	A	A	B—	A—	A—	B—	A	B	B+	
Male.....												Inc.	
Female.....	17	B	A—	B	A	B—	A—	A—	B—	A	B	B+	
Female.....	16	B	B	C	B—	B—	C	A	C	A—	B	B—	
Female.....	13	B	A—	B	A	B	A—	B	C	A—	A	B+	
Male.....	10	B	B+	B	B	B	B+		B+	A—	B	B+	M
Male.....	5	B	A	B+	B—	B	B+		B	A	B	B+	
Family Score: B+													
Entry No. 4—													
Male.....	38	B+	B—	B	A	A	B+	B+	C	A—	A—	B	
Female.....	37	B+	A	C+	A	B+	B+	A—	D	A	A—	B+	
Male.....	5	B+	B+	A	A	A—	B+		A	A	B+	A	M
Family Score: B+													
Entry No. 5—													
Male.....	44	B	B	C+	A	B+	B—	A—	C+	B+	B+	B	
Female.....	40	B	A—	B	A+	B—	B	A—	B	A	B+	B+	
Male.....	14	B	A—	C	A	B+	B		B	B+	A—	B+	
Male.....	12	B	A—	C	A	B	A		B	B	A—	B+	
Male.....	11	B	A	C—	A	B+	A		B	B+	B	B+	
Female.....	10	B	A—	C—	A	A—	B+		B+	A	B	B+	
Female.....	8	B	A—	B	A	A—	B+		B+	A—	B	B+	M
Male.....	6	B	A	A	A	B+	B		B	A	B	B+	M
Female.....	4	B	A	E	A	A—	B+		A	A	B+	B+	
Male.....	2	B	A		A	A—	B—				A	A—	
Family Score: B+													

Those individuals whose total average entitles them to an individual award are indicated by "M." In order for an individual to obtain an award, he must receive a score of B or better in every examination. This is not an easy record to achieve, since a single B— could thus disqualify an individual whose average was B+ or better.

	Age	Eugenic	Social	Psychometric	Psychiatric	Structural	Medical	Laboratory	Dental	Special Senses	Health Habits	Total Ind. Score	Ind. Awards
Entry No. 6—													
Male.....	32	B	B—	A	A	B—	B	B—	B	B+	B	B	
Female.....	32	B	B	B	A	A—	B—	C—	B	B	B	B	
Female.....	7	B	B+	B	A	A—	B+		B	A	B—	B	
Male.....	4	B	B+		A	B+	B	C—	A	C+	B+	B+	
Female.....	26 mo.	B	A	A	A	A	A				A	A—	M
Female.....	3 mo.	B	B+	A	A	A	A				A	A—	M
Family Score: B+													
Entry No. 7—													
Male.....	48	B	B	A+	A	B+	A—	A	B	A	B	A—	M
Female.....	45	B	A	C+	A	B	A	B	C+	A—	A	B+	
Male.....	15	B	A	C	A	B	A—	A—	A—	A	B+	B+	
Female.....	10	B	A	A	A	A	A—		B	A+	A—	A—	M
Family Score: A—													
Entry No. 8—													
Male.....	30	B	B	B—	A—	B	B	C	B	B	B	B	
Female.....	31	B	A—	A	A—	A—	B+	B—	D	B	B—	B	
Male.....	5	B	A—	C	B	B	B	B—	A—	A	B—	B	
Male.....	3½	B	A—	C—	B	A—	B		B	A	B	B	
Female.....	2 mo.	B	A		B	A	A				A	A—	M
Family Score: B													
Entry No. 9—													
Male.....	50	B—	A	B	A	B+	B+	B	B	A	A	B+	
Female.....	37	B—	A	A	A	A—	B	B—	A	A	B	B+	
Male.....	6	B—	B+	C+	A	B—	A		B	A	B+	B+	
Female.....	3½	B—	A	D	A	A	A		A	A	A—	A—	
Family Score: B+													
Entry No. 10—													
Male.....	34	C	B+	A	A	B+	B	A	C	A	A—	B	
Female.....	36	C	A—	B	A—	B—	B	B	C	B+	A	B—	
Female.....	5	C	B—	C+	A	A	A—		C	A	A—	B+	
Male.....	3	C	B—		B	B+	B		A	A	A	B—	
Male.....	25 mo.	C	A		A	B+	A		C		A	B—	
Family Score: B—													

	Age	Eugenic	Social	Psychometric	Psychiatric	Structural	Medical	Laboratory	Dental	Special Senses	Health Habits	Total Ind. Score	Ind. Awards
Entry No. 11—													
Male.....	28	B	B	A	A	B+	A—	B	C	A	B	B+	
Female.....	5	B	C+			A	A			A—		Inc.	
Male.....	3	B	B			A	A	B		A		Inc.	
Family Score: Incomplete													
Entry No. 13—													
Male.....	47	C	A	A	A	B—	A—	B	C	A	B	B+	
Female.....	46	C	B+	A	B—	B—	A	C	B	B	A	B	
Male.....	21	C	C	A	A	B	A	B	C—	B	C	B	
Female.....	17	C	B+	A	A	B—	B+	C	B	B—	A—	B	
Male.....	12	C	A	A	A	B+	A—		B	B	B	B+	
Male.....	10	C	B	D	A	B—	B		A—	B	A—	B	
Male.....	9	C	B	D	A	B+	B		A—	A—	A—	B	
Family Score: B													
Entry No. 14—													
Male.....	48	B	B+	B	A	B+	A—	A	A—	A	B+	B+	M
Female.....	43	B	B	C+	A	B—	B	B	B	A	B—	B	
Male.....	17	B	B	C	A	B+	A		B	A	B	B+	
Male.....	16	B	A	A	B	A	A		A—	A	A—	B+	M
Female.....	15	B	A	B	A	B+	A	A	B+	A	A	A—	M
Male.....	13	B	A	A	A	B	B		A—	B	A—	A—	M
Family Score: B+													
Entry No. 15—													
Male.....	43	C	B	C—	A	B—	A—	A	B	A—	B+	B	
Female.....	42	C	C	C—	A—	B	A—	B—	B—	B	B—	B—	
Male.....	13	C	B	B	A	B	A	B	A—	A—	A—	B+	
Family Score: B													
Entry No. 16—													
Male.....	47	B	A	A	A	B—	A	A	B+	B+	B—	A—	
Female.....	48	B	B	B	B	B+	A	B—	B	B	B+	B+	
Male.....	17	B	A	B	A	B	A—	B	A—	B	A	B+	M
Male.....	15	B	A	C	A	B—	A		B	B+	B+	B+	
Male.....	13	B	B+	A	A	B+	A		B	B	A—	B+	M
Female.....	12	B	B	A	A	B+	B	B—	A	A	B—	B+	
Male.....	9	B	B+	B	A	B	B+		A—	B	B	B+	M
Male.....	7	B	B	A	A	B	B		B	B	B	B	M
Male.....	5	B	B	B	A	B	B		A	A	B+	B+	M
Family Score: B+; Family Medal													

1. Entries Nos. 12 and 19 did not complete sufficient tests to be represented in the scoring.

	Age	Eugenic	Social	Psychometric	Psychiatric	Structural	Medical	Laboratory	Dental	Special Senses	Health Habits	Total Ind. Score	Ind. Awards
Entry No. 17—													
Male.....	39	B	A—	A	A	B—	B+	B	B	A—	B	B+	
Female.....	33	B	B+	A	A	A	B	B—	B	B	B	B+	
Female.....	8	B	B	B	A	A	A		A	A	A—	A—	M
Female.....	7	B	B	A	A	B+	A		A	A	A—	A—	M
Male.....	3	B	B+	A	A—	B	A		A	A	A—	A—	M
Male.....	5½ mo.	B	A			A+	A				B	A—	M
Family Score: B+; Family Medal													
Entry No. 18—													
Male.....	40	B—	B+	C—	A	B	B+	B	B+	C	A	B	
Female.....	28	B	B+	C	A	B	A	D	B	A	A	C+	
Family Score: B—													
Entry No. 20—													
Male.....	21	C+	A—	C	A—	B—	B+	B	F	A	B—	B—	
Female.....	22	C+	C+	A	A	B—	B—	B	D	B+	B	B	
Family Score: B—													
Entry No. 21—													
Male.....	33	B	C+	A	A	B+	A	B	D	A—	A	B	
Female.....	32	B	B—	C+	A	B+	B	B	D	A	A	B	
Female.....	7	B	B	A	A	B+	B		D	A	A	B	
Female.....	30 mo.	B	B+	B+	B+	A	B+				A	B+	M
Family Score: B													
Entry No. 22—													
Male.....	28	B—	A	A	A	B	A—	B—	B	B—	B	B+	
Female.....	25	B—	B+	A	A	A	A	B—	B+	A	A—	A—	
Female.....	17 mo.	B—	A	A	A	B	B				A	A—	
Family Score A—; Family Medal; No Individual Medals													
Entry No. 23—													
Male.....	45	B—	B	C+	A	B	B—	B	C	B	A—	B	
Female.....	46	B—	B	C+	A	B+	B—	B—	D	A	B	B	
Male.....	14	B—	B	A	A	B+	A—		B	C+	A	B+	
Female.....	12	B—	B	B	A	B	A	B	D	B+	B	B	
Family Score: B													

	Age	Eugenic	Social	Psychometric	Psychiatric	Structural	Medical	Laboratory	Dental	Special Senses	Health Habits	Total Ind. Score	Ind. Awards
Entry No. 24—													
Male.....	31	B	B	B	A—	B—	A—	B—	C	B—	B—	B	
Female.....	23	B	B	B—	A—	B—	A—	B	C	B—	B	B	
Family Score: B													
Entry No. 25—													
Male.....	44	B—	B+	C+	A	B+	B	B	E	A	B+	B	
Female.....	37	B—	A	A	A	B	B—	B	D	B	A—	B	
Female.....	13	B—	B+	A	A	B—	B+		C+	A	A—	B+	
Female.....	10	B—	A	C	A	B	B—		D	A	A	B	
Male.....	8	B—	A—	A	A	B—	B		D+	C+	A	B	
Family Score: B													
Entry No. 26—													
Male.....	38	B	A	A	A	B+	B	B	B	B	B—	B+	
Female.....	37	B	B+	B	A	B	A	B—	C+	B	B	B	
Male.....	4	B	A	C	A	B—	B—		B+	A	A—	B+	
Female.....	20 mo.	B	A	A		A—	B				A—	B+	M
Family Score: B+													

The individuals participating in the Contest are here grouped in families in order of entry (See Table I, Column 1). The several departments of the examination are each represented by one of the columns remaining, as indicated by the captions. The twelfth column gives the individual's total score if his tests were sufficiently complete to warrant compiling the average. Blanks in the columns represent either children who were not required to take all tests or adults who were unable to give sufficient time to the examinations to receive a score in all departments. Age and sex of individuals are indicated in each case.

INTERPRETATION OF INDIVIDUAL SCORE

One hundred eleven individuals either completed their tests or so nearly completed them as to make possible the calculation of an individual score. The individual score is arrived at by assigning numerical values to the letter scores and calculating the average. This is then retranslated into letter scores and appears as such on the data sheet. As might well be expected from such a method of procedure, there

was no one who received a higher individual score than A, or a lower individual average than C+. The distribution is as follows:

A 2	18 A	(all kinds)
A—.....16		
B+.....52	92 B	(all kinds)
B 34		
B—..... 6		
C+..... 1	1 C	
Total number of individuals.....	111	

TABLE II

INDIVIDUAL SCORES—DISTRIBUTION ACCORDING TO AGE AND SEX

Class	A	A—	B+	B	B—	C+	*No. of Individuals*
Adult males	0	2	11	12	1	0	26
Adult females	0	1	9	10	2	1	23
Male children	2	4	22	6	2	0	36
Female children	0	9	10	6	1	0	26
Adults (both sexes)	0	3	20	22	3	1	49
Children (both sexes)	2	13	32	12	3	0	62
Females (all ages)	0	10	19	16	3	1	49
Males (all ages)	2	6	33	18	3	0	62

Comparing A scores (of all kinds) with B scores (of all kinds), it is interesting to note the distribution with respect to the sex and with respect to the age of the participants (See Table II). An individual score of A or A— was received by eighteen individuals of whom only three were adults, while fifteen were children. Ninety-two individuals received a score falling in the B class. Of the 52 B+ individuals, 11 were mature males, 9 mature females, 22 were male children and only 10 female children. This last discrepancy may be explained by taking into account the fact that 36 boys were examined as compared with only 26 girls, and B+ being the mode, we should naturally expect the number of B+ male children to exceed considerably the B+ females. Again, of the A and A— classes, 9 were girls while only 6 were boys. This accounts further for the scarcity of girls in the class immediately below.

INFLUENCE ON SCORE OF AGE OF PARTICIPANTS

Among those receiving the score of B, we find 12 men and 10 women, but only 6 boys and only 6 girls. The B— scores are not significant, including only 1 adult male, 2 adult females, and 3 children, 2 males and 1 female. I believe it is apparent from the figures that sex, either of children or adults, is of negligible significance with reference to the final results, but that the age of the participants does seem

to correlate somewhat with their final scores. There are at least two reasons for this:

(a) Infants were given no psychometric or laboratory tests, and in very many cases no dental or special sense examinations, whereas all older children and adults were examined in these as in other departments. Such infants almost invariably passed high in all departments with which they had anything to do, and received a higher individual score than they will probably be able to secure a few years hence.

(b) By examining the data sheets, it is easy to see that the parents tend throughout to receive a lower score under "Dental" Examination than do their children. This one item alone was in many instances sufficient to affect materially the individual's final average and to bring it slightly below that of his own children. Whether this difference in dental condition is due to the fact that modern children receive better care with respect to their teeth than did their parents when they were children, or whether these youngsters have not yet "lived into the age when white men lose their teeth" is not certain. Probably both suggestions are true within certain limits. It seems almost an established fact that civilized men are losing their teeth from behind forward, a perfect set being just about impossible to find in adult individuals, though we do find many children with practically perfect teeth that have never as yet required the services of the dentist. When it comes to the matter of caring for the teeth, diet—both of the pregnant or nursing mother and of the growing youngster—seems to be of great importance.

OVERCOMING DIFFICULTIES IN SCORING

I have analyzed the distribution of scores in the several departments of the examination. This has been particularly helpful in showing where and how our scoring methods may be inconsistent or otherwise unsatisfactory.

The data sheets show altogether 1,031 items scored, for all participants. Of these, 405 are A (of all kinds), 525 are B (of all kinds), 85 are C, and 19 are D or lower. This is not far from normal expectation, and we might be justified in assuming that should we plot the curve of all items scored from A+ to F, the curve would show a normal distribution with B+ as the mode. This was attempted, using plus and minus signs to give an accurate grade in all 12 classes in which it was possible for scores to fall. The results were disconcerting, and may be explained only by assuming that examiners, almost without exception, were very loath to utilize the plus and the minus signs except in puzzling or border line cases. There is consequently a great preponderance of A, B and C scores with the A— and C+ in particular falling far below expectancy. The excessive number of

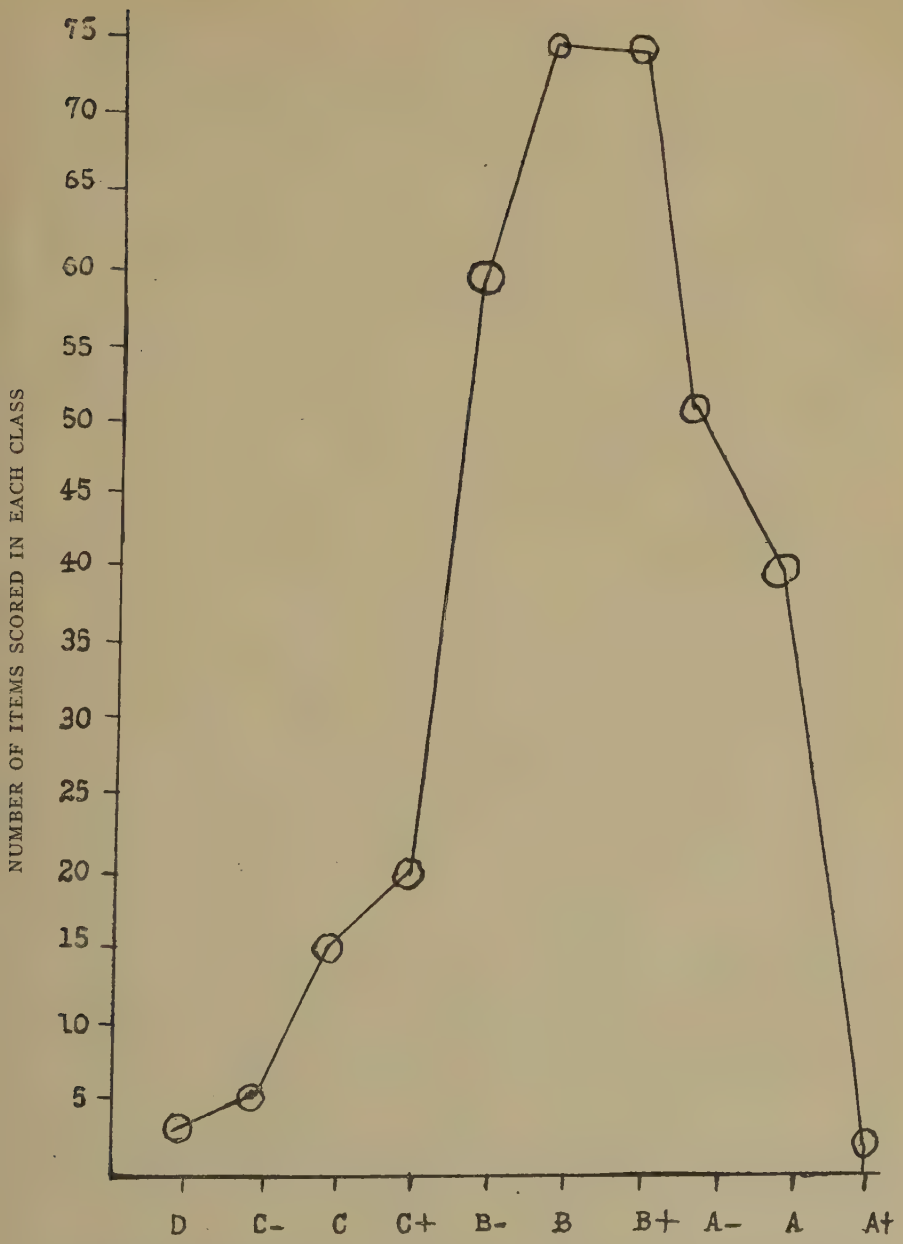


PLATE 1. Showing distribution of scoring for adult males, the scores under Psychiatry having been eliminated and the + and — classes having been multiplied by the constant 2 to compensate for known failure of examiners to use + and — symbols. Having made these allowances, the curve *tends* to show, even with such small numbers, a normal distribution, and to indicate that the method of scoring is fundamentally sound.

A scores is no doubt traceable directly to the method of scoring used in the Department of Psychiatry where the examiner could not well give a score other than A when the individual tested normal in all respects, a wise procedure since in this particular field any lower score would have led the participant to demand lengthy explanation from the examiners.

But, if merely for the purposes of illustration, we confine ourselves to adult males alone and exclude from our calculation the scores under psychiatry, we have a fairly satisfactory curve as shown in the accompanying plate. (Plate No. 1). In this plotting, the A+, A—, B+, B—, C+ and C— points have all been moved up by multiplying the actual count by the constant "2," which was arbitrarily assumed as indicating the probable variation from expectancy due to examiners failing to utilize the plus and minus system.

RELATION OF PEDIGREE AND SOCIAL HISTORY TO CAREER

It is possible, however, to show distribution of scores in the several departments of the examination by lumping together all scores under the four heads: A, B, C, and D, as in Table III. From these data were prepared the diagrams shown in Plates 2, 3, 4, 5, and 6. The particular value of these diagrams (assuming that the method of scoring is essentially sound) lies in their indication of those fields wherein our "highly selected group" tended either to excel or to be deficient. The average individual scored high, as might be expected from the fact that these families were admitted to the contest only by invitation, and no individual was examined who was not apparently in normal health. The genealogical scores fall largely in the B class, which fact may be of significance in showing that a good, though not necessarily exceptional pedigree, is to be correlated with a reasonably successful career. Apparently a fine individual social history is a more important factor in evaluating fitness than an exceptional heritage, though the first, as we all know, may be due directly to the latter. It is, of course, obvious that very few individuals such as were invited to participate in this Contest would show a social history lower than B—. Failure in school or in business (traceable to deficient mental capacity, chronic ill health, or both) are generally grounds for rating social history low. The diagram showing distribution of scores in the

By actual count 26 adult males, each examined on 10 points, plus three who received a eugenic score but were not examined otherwise, received a total of 263 ratings of which 91 were A's, 141 B's, 28 C's and 3 D+ or lower (Psychiatry ratings included).

It will be noted that the mode includes both B and B+, whereas the final individual averages show a greater number of individuals with a score of B+ than with any other. This rating also is to be accounted for by reason of the large number of A scores recorded under Psychiatry, which in the final calculation swings the average into the B+ column.

TABLE III

Dept. of Examination	*Total No. of scores entered*	A+, A, A—	B+, B, B—	C+, C, C—	D+ or lower	C+ or lower
Eugenic	114	4	93	17	0	17
Social	114	47	61	6	0	6
Psychometric .	102	43	26	29	4	33
Psychiatric ...	109	97	12	0	0	0
Structural	113	26	86	1	0	1
Medical	112	52	59	1	0	1
Laboratory ...	62	13	42	6	1	7
Dental	93	10	52	17	14	31
Spec. Senses..	101	62	35	4	0	4
Health Habits.	111	51	59	1	0	1
Total number of scores in each class ...	1031	405	525	82	19	101

NOTE.—Adult males alone received 91 A's (of all kinds), 141 B's, 28 C's and 3 D's, or lower.

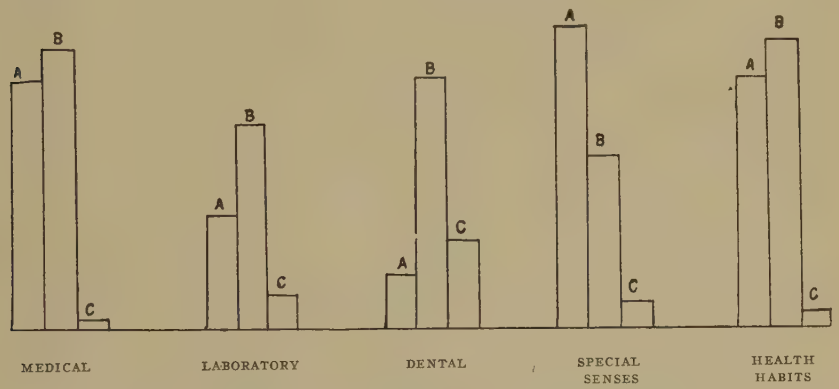


PLATE 2. Showing graphically the distribution of scores in each department of the Contest.

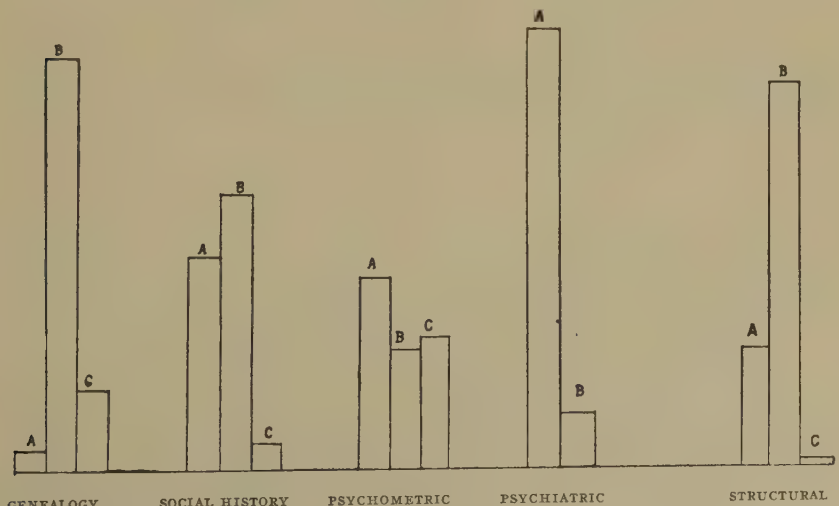


PLATE 3. Showing graphically the distribution of scores in each department of the Contest.

psychometric field (See Plate 3) is evidently an unnatural one, but there were reasons for believing that the scores from this department of the examinations were perhaps the least dependable of all phases of the work. It is hoped to improve the methods of taking mental measurements as they are applied in the Fitter Families Contest work, and to

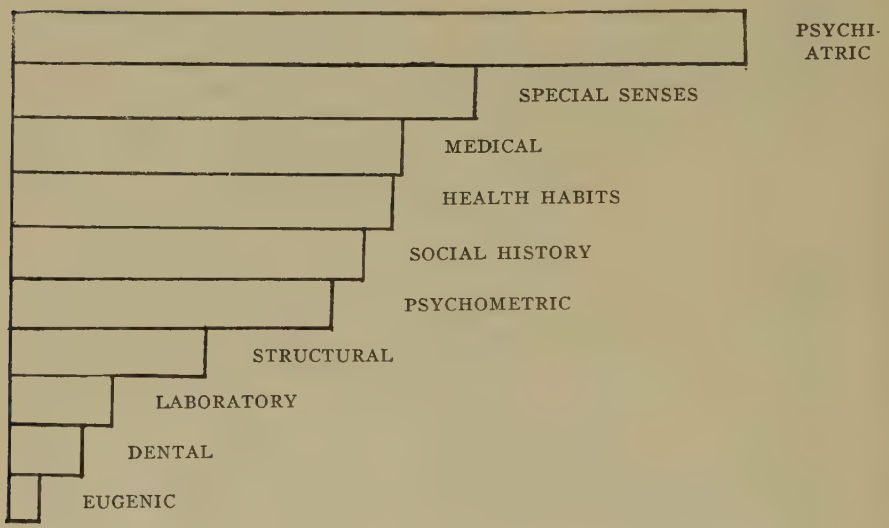


PLATE 4. Showing distribution, among departments of the 405 score items receiving A—, A or A+. While this tends to show primarily which departments were conservative in the scoring and which were not, it may possibly be of value in indicating the relative importance to the individual of a "nearly perfect" condition in each of the several fields. No one will deny that normal mentality is of paramount importance, while we all know that A pedigrees are not at all necessary for the production of successful individuals.

eliminate the uncertainty that now prevails regarding the accuracy of these tests. In any event, the diagram shows quite clearly that intellectual excellence is of paramount importance in determining an individual's fitness for successful survival under modern conditions.

RELATION OF CONSTITUTIONAL FITNESS TO HIGH SCORE

The "Structural" diagram (See Plate 3) is quite as we might expect. Certain structural deficiencies, such as slight spinal curvature, relative disproportion of chest, waist, hips, etc., might easily keep an individual

from falling in the A class, while interfering not in the least with his capacity to become an outstanding success in life. To primitive man, excellent muscular development, chest capacity and endurance were of prime importance. Today these items are of secondary importance.

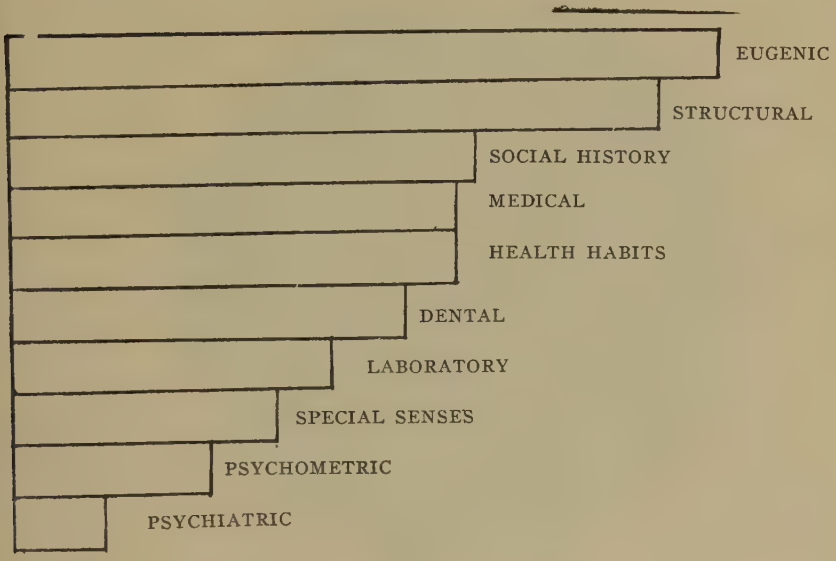


PLATE 5. Showing distribution among departments of the 525 score items receiving B—, B or B+. In many instances the B's appear to compensate for the A's and vice versa. Hence, though an A pedigree was not essential for success, as shown in the first chart, a B genealogy seems to be of very frequent occurrence in our reasonably successful individuals.

More important than muscular development is constitutional fitness, and this we find indicated by the diagram labeled "Medical" (See Plate 2). The A's are almost as numerous as the B's, showing that our selected group probably owe their capacity to carry on the world's work more to their sound heart, lungs, kidneys, etc., than to their muscular development or graceful proportions. The "Laboratory" diagram (See Plate 2) covers so many items that it is difficult to interpret the picture without analyzing the data. A laboratory average of B is not indicative

of any serious constitutional conditions. It is more likely to be correlated with indifferent health habits which might easily account for a trace of indol in the urine, positive toxin, etc., any one of which would keep the individual out of the A class.

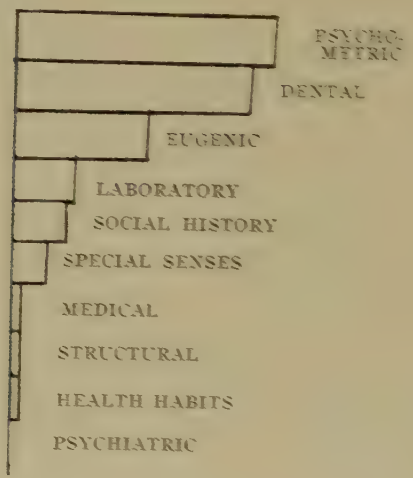
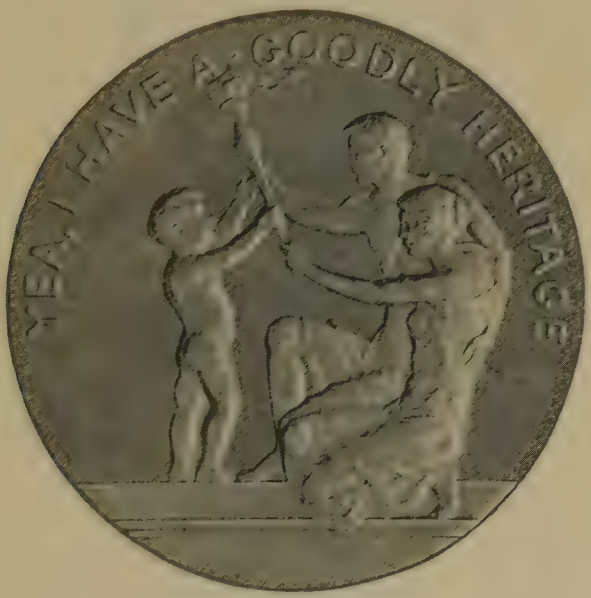


PLATE 6. Showing distribution, among departments, of the 101 score items receiving C− or lower. Excluding the psychometric column, which is obviously incorrect, the diagram, when read from top to bottom, tends to indicate the relative extent to which modern man may be deficient in any particular and still survive with reasonable chances of success.

GOOD TEETH NO LONGER OF SURVIVAL VALUE?

The "Dental" curve (See Plate 2) is interesting, for the A's are fewer than the C's, which are more numerous than in Health Habits, Special Senses, Laboratory, Medical, Structural, and Social History. Modern man certainly seems to be getting along and surviving fairly well with very poor teeth. Without modern dentistry most of us would probably become crippled with rheumatism at an early age, and if we did not slowly starve to death through inability to masticate our food, our general efficiency would be greatly impaired and our days shortened.

Under modern conditions, good teeth are not of survival value, inasmuch as the man with a complete artificial set often seems better off than the man who tries to hold on to his natural ones. Man is making the most of an apparently unavoidable evolutionary tendency. It is difficult to foresee the final results.



Bronze Medal Awarded to Prize-Winning Families by the American Eugenics Society, Inc.

The "Special Sense" diagram (See Plate 2) is significant. Good eyes and ears, sinuses that behave and throats that stand hard use are great assets in the race for success.

Of no less importance are the "Health Habits" (See Plate 2). Here it is *possible* for the individual who takes only fair care of himself to show up favorably against the individual who takes excellent care of his body, hence the B column is even slightly higher than the A. This is because the results of bad health habits are not so immediately apparent. They are more subtle in their operation. But there is no question as to the correlation of greater life expectancy with improvement in health habits. It happened that there were no individuals of advanced years included in this group. Had there been, the health habits diagram would probably have been affected thereby,

and it is very probable indeed that among successful people over 70, the A column would well out-balance the B.

In the foregoing discussion I made no mention of the Psychiatric records, as I have discussed those elsewhere. Taken together with the

Race Betterment Badge Awarded to the Individual Prize Winners

Psychometric analyses, they certainly show the value of *normal* as well as *capable* minds in carrying on the world's work, and that "fit families" should possess both.

PRIZE-WINNING FAMILIES AND INDIVIDUALS

The awards consisted of the usual bronze medals furnished by the American Eugenics Society. The head of each winning family was presented with a three-inch medal bearing the inscription, "Yea, I have

a goodly heritage." The individual awards consisted of smaller medals appropriately engraved. The participating families were divided into four classes: Large families (five or more children), medium sized families (three or four children), small families (one or two children), and childless couples (engaged couples eligible).

It was impossible to complete the scoring in time to present the awards during the Conference. These awards were later presented at a banquet given by Dr. John Harvey Kellogg to all individuals having a part in the Contest, either as participants or as examining specialists.

Highest Scoring Individuals

ADULT—Male: Colver, Dr. B. N.
ADULT—Female: Kellogg, Mrs. Adeline.
CHILD—Male: Tarbell, Luther, Jr., Son of Dr. L. A. Tarbell.
CHILD—Female: Colver, Nancy, Daughter of Dr. B. N. Colver.

Individual Medals

Barney, Mr. Nathaniel A., 1300 W. Main St., Battle Creek.
Barney, Althea M., 1300 W. Main St., Battle Creek.
Carpenter, Mr. Russell, 53 Garrison St., Battle Creek.
Colver, Dr. B. N., 182 Manchester St., Battle Creek.
Colver, Nancy, 182 Manchester St., Battle Creek.
Gibbs, Mary, Urbandale, R.F.D. No. 7.
Haughey, Wilfred, 40 Poplar St., Battle Creek.
Haughey, Philip, 40 Poplar St., Battle Creek.
Haughey, David, 40 Poplar St., Battle Creek.
Haughey, Charles, 40 Poplar St., Battle Creek.
Haughey, Louis W., 40 Poplar St., Battle Creek.
Heald, Dr. J. E., 38 Ann Ave., Battle Creek.
Heald, Eugene, 38 Ann Ave., Battle Creek.
Heald, Florence, 38 Ann Ave., Battle Creek.
Heald, Gordon, 38 Ann Ave., Battle Creek.
Hussey, Roland F., Jr., University Hall, Battle Creek.
Hussey, William J., 2nd., University Hall, Battle Creek.
Jickling, Rhoda Jane, 150 Chestnut St., Battle Creek.
Jickling, Esther Elizabeth, 150 Chestnut St., Battle Creek.
Jickling, Robert Mason, 150 Chestnut St., Battle Creek.
Jickling, David Lee, 150 Chestnut St., Battle Creek.
Kellogg, Mrs. Adeline, 25 Fremont St., Battle Creek.
Neal, Betty A., 123 Greenwood, Battle Creek.
Neal, Margaret L., 123 Greenwood, Battle Creek.
Redner, Keith, Country Club Hills, Battle Creek.
Redner, Gordon, Country Club Hills, Battle Creek.
Snyder, Hazel, 15 South Michigan, Battle Creek.
Sparks, Marguerite, Jr., 25 Bowen St., Battle Creek.
Tarbell, Luther, Jr., 21 Greenwood, Battle Creek.

Family Medals

Class 1—Engaged or Childless Couple

Lindsey and Opal Fairchild, 34 Walter Ave., Battle Creek.

Class 2—Parents with 1 or 2 Children

B. R. and Thelma Swanger, 739 Audubon Blvd., Jackson, Mich.
One Child

Class 3—Parents with 3 or 4 Children

Robert L. and Margaret C. Jickling, 150 Chestnut St., Battle Creek.
Four Children

Class 4—Parents with 4 or More Children

Dr. Wilfred and Edith Haughey, 40 Poplar St., Battle Creek.
Eight Children

This lad scored highest among male children entered in the Fitter Families Contest

LUTHER TARBELL, JR.

Son of Dr. and Mrs. L. A. Tarbell, 21 Greenwood Ave., Battle Creek

THE RATE OF PULSE

One of the Items in the Health Examination of the Fitter Families Contest

POSSIBLE FURTHER DEVELOPMENTS—EUGENIC RESEARCH

It became apparent during the Contest that probably nowhere in the country could there be found a more satisfactory aggregation of facilities for such work than at the Battle Creek Sanitarium, and it has been suggested by Dr. Sherbon, who directed the practical work of examining and scoring, that a Fitter Families research project be carried on with Battle Creek as headquarters, for the express purpose of improving our methods in measuring the fitness of individuals and of families in their relation to society. Whereas the Fitter Families Contests as at present organized are reasonably successful and fairly accurate in results, there is tremendous opportunity for improvement in certain phases of the work. Much discussion has arisen concerning the psychometric analysis to which each individual is subjected. It is felt that perhaps our methods discriminate against the agricultural individual who is less skilled in the use of a pencil, hence less able to give a proper account of his intelligence than is the individual employed in some clerical work. I have already touched upon the limitations that exist in making an accurate interpretation of the genealogical data.

The psychiatric examination, also, must of necessity be carried on within a very limited time, if the examiner has contact with the individual only during the period of the Contest, and this field of all others requires a considerable opportunity for the examiner to become familiar with the individual's personality, if a correct analysis is to be made. The examiners in the special senses are not given adequate opportunity to express all their findings on the score card as it is at present constituted. This is probably not a criticism of the score card when used at fairs or under other circumstances where specialists may not be available, but in such a project as is here suggested, a much more thorough tabulation of conditions is desirable, along with repeated examination of the same individuals.

Our method of scoring the teeth opens up many problems, for here we find that perfect teeth practically never exist; hence, the "normal" individual, if by normal we mean "average," may be perfectly successful in life even though he has lost all of his teeth at thirty. Yet according to common-sense standards such an individual is far from perfection and could hardly be desired as a type for the race. To what extent we can allow irregularities in dentition, without materially reducing the individual's score, is questionable. This is one of the phases of the Contest that should be thoroughly investigated.

A PRACTICAL PLAN FOR EXTENSION OF THE WORK

A committee is at work to draft a plan whereby this project may go forward, utilizing the Medical Staff of the Battle Creek Sanitarium

and the Teaching Staff of Battle Creek College, while the Eugenics Record Office will probably function in an advisory capacity. Our tentative scheme proposes an annual examination of all members of certain selected families over a period of at least five years, at the end of which time the advisability of continuing for another five years would be considered. These examinations would be many times more extensive than those now employed in the Fitter Families Contests, and should, if properly conducted, yield a mass of data exceedingly helpful in organizing further enterprises along these lines.

Besides arriving at more accurate methods of measuring, the project might be expected to arrive at the following objectives: (1) To establish a scientific definition of what we mean by the "normal" individual as contrasted with the "average," also thus to arrive at a scientific definition of the so-called "superior" type; (2) to pave the way for ascertaining the "true aristocracy" of a community or a nation as opposed to false standards of aristocracy now in vogue, and to extend due recognition to those stocks determined to be genetically superior; (3) the most logical recognition would be admission to the "Eugenics Registry" which thus would become a more valuable source of record for students of American genealogy and at the same time better fulfill its original purpose as a means of stimulating a "eugenic conscience" in the minds of our best people.

THE EUGENICS REGISTRY

The Eugenics Registry is a very properly conceived idea for placing the truly superior stocks on record, and the idea has met with the approval of most individuals concerned with eugenic work. Its greatest limitations have come from the fact that our methods of measuring superiority have been somewhat haphazard and undependable. The only solution lies, of course, in the accumulation of a mass of sound and scientific data bearing directly on just what constitutes "fitness for life" under the civilized conditions that now obtain. Such a research enterprise as Dr. Sherbon suggests should furnish the exact material needed for establishing the Eugenics Registry on a sound basis.

EUGENICS EDUCATION

It appears that the time has come even with the limited knowledge at our disposal to stimulate greater interest in human inheritance by means of contests, lectures, demonstrations, newspaper publicity and other similar agencies. It has been proposed to extend especially the scope and activity of the Fitter Families Contest. This work hitherto has been entirely in the hands of the Popular Education Committee of the American Eugenics Society. It is practically impossible, however, for that organization materially to enlarge this work without additional

funds and additional personnel. On the other hand, the Race Betterment Foundation would be in an excellent position with headquarters at Battle Creek to foster such an extension of the popular education work, and it is possible that the Fitter Families Contest will be turned over to the Race Betterment Foundation for administration. The Eugenics Society would, of course, continue to cooperate in every way, and would furnish exhibits, advertising and other appropriate assistance.

THE RESPONSIBILITIES OF THOSE WHO ARE FIT

(An Address to the Prize-Winners in the Fitter Families Contest)

Dr. John Harvey Kellogg

You have submitted yourselves to a most exhaustive examination by a large corps of experts. You have successfully passed these exacting tests, and have proved yourselves—children, parents, grandparents, families—to be worthy of this special recognition.

It is a splendid thing to be a member of a good family, the finest thing in the world, in fact. As a great author has told us, "It is the greatest of all felicities to be well born."

I want particularly to impress upon you the fact that you are prize-winners, and that means that you stand a little higher in the scale of being than the average, and that for this reason you are entitled to special consideration and worthy of special care. The owner of a prize-winning horse takes extra good care of him. So these prize-winners are under obligations to themselves and to the community to preserve intact the splendid qualities of mind and body that have been handed down to them from their predecessors so that they may be able to pass on their superior health to those who come after them.

And the parents of these prize-winning children must always remember that they are prize-winners, that they must receive the extra care and the special protection that prize-winners are entitled to. The parents must see that these little folks are protected from such infectious diseases as measles, scarlet fever, whooping cough, etc., for these troubles often leave damage behind. The injury may not be apparent, but it is there, and will appear in later years in some form of chronic disease and in the shortening of life.

HAVE A PERIODIC EXAMINATION BY THE FAMILY DOCTOR

Every prize-winner should have every six months, or at least every year, an examination by the family doctor, in order to make sure that the blood is one hundred per cent, that the eyes and ears are sound, and that no disease is getting a foothold. The rate of growth, the weight, especially the diet, should be carefully checked, and habits of out-of-door life, sun bathing, and all that pertains to healthful living, must receive careful attention.

A Group of Physicians and Other Specialists Who Gave Their Services in Examining and Scoring Participants in the Fitter Families Contest

BE TRUE TO NATURE

Of course no prize-winner will ever touch alcohol or tobacco. Tea and coffee must also be let alone. These are all enemies of the body that cause disease and shorten life.

We want to inspire in these boys and girls the idea of being true to nature, of taking care of this masterpiece of God that they have been given—their bodies.

There is a right and a wrong way to live. It is well to learn early that it pays to be good to one's self.

I am glad there is being started a real "aristocracy," that in this little town of ours the beginnings of a Better Race are being developed. And I congratulate you that you have the privilege of being pioneers in this great and significant undertaking.

A UNIQUE EXPERIENCE

Dr. Florence Brown Sherbon, Director of the Bureau of Child Research, University of Kansas

(The Fitter Families Contest was held under the supervision of the American Eugenics Society, Inc., Mr. Leon F. Whitney, Executive Secretary, and under the direct charge of Doctor Sherbon.)

Mr. Whitney and I have had a very unique experience this week. We have been accustomed to draft our staff from two to six or eight institutions, colleges, hospitals, boards of health or from any other place we could assemble this aggregation of talent that it takes to examine our families, and to cart them bodily out to a fair ground, to set up a temporary equipment in any sort of building that was available for the purpose and to examine these families as best we might. So, imagine the contrast it was for us to come here to the Battle Creek Sanitarium where we have had everything that human science affords—velvet carpets under our feet, exquisite food served at our need and such a force of scientific and professional talent at our services as we had never dreamed could be possible.

I think that possibly the Sanitarium has had a somewhat unique experience also. This may have been the first time in its experience that 125 hand-picked normally superior individuals were run through its diagnostic machinery, and the significance of that has grown upon me as the week has passed.

This movement originated in a state fair. The Better Babies movement originated in a state fair. Both movements have had their extension through the agency of agricultural fairs and expositions. I doubt if at this time you could go into an agricultural fair of any size, either county or state, without finding as one of its features a health examination of some kind.

Eight years ago in Kansas we called the family to come along with the baby. We feel that the agricultural fair was the logical place for this movement to have its origin. It is simply an extension of scientific plant and animal husbandry to the next higher order of creation and we are thereby creating the science of human husbandry. It is just as simple as that. The families we found were willing to come along with the baby. They came to the fairs for this all-round extensive examination, which does not pretend to draw any more line between heredity and environment than is drawn by the stock judge when he judges and examines stock and takes into consideration the heredity, the feeding and the care of the product.

The idea has spread to some dozen other states, and is still spreading as it seizes the consciousness of the people.

Now, I feel that this Race Betterment Foundation here in Battle Creek may be the scientific center that we have sought, to be to this movement what scientific research and study have been to agriculture.

LET US HEAR MORE OF THE FINER FAMILIES

We have been having a lot of panic about the family. Social workers have been concentrating their attention upon the family. We blame the family for everything now—delinquency, dependency, the revolt of youth and everything else. In the last two days and a half we have examined twenty-four of your Battle Creek families, and they are of such a character as I believe would put courage and hope into the heart of the most skeptical person I can imagine. You cannot meet such families as have assembled in your parlor down here, and given hours of their time with the utmost patience to the trying procedure through which we have put them, and look at the vigor, the buoyancy, the sense of morale and the comradeship that exist in those family groups, and look at the size of the families, and not be pretty optimistic. We have two magnificent eight-children families, and just as we were closing today a family of seven came in. They were certainly a joy to behold. We have had families of six and five and four, and I tell you it would just do you good to look at them. We are not hearing so much about these families. We are only hearing about the families that break down. I want to tell you that there are a mighty lot of the finest families the world has ever seen right with us today, and you seem to have your full share of them here in Battle Creek.

We certainly appreciate this opportunity of bringing our idea to you, and we cannot express our appreciation of the hospitality and the cordiality with which our efforts have been received.

It is going to be very hard to select the winners because all these families are superior families, but there will be some who will shade a little bit higher than the others, and you will have the pleasure of felicitating them.

THE MENACE OF THE HALF-MAN

JUDGE HARRY OLSON, The Municipal Court of Chicago, Illinois.

The cause of crime traditionally has been wickedness, perversity, viciousness. When Church and State were one, this explanation seemed especially appropriate. Historically the prevention of crime has been through—

a. Killing the criminal.

b. Confining the criminal.

c. Deterring others by force of example.

Applied with great rigor, the above program can keep and has kept crime relatively low, but the most oppressive penalties have never deterred all wrong-doers.

When it was observed that capital punishment, as applied to a large number of common offenses, failed to deter many others, there was a change of policy whereby capital punishment was reserved for a few of the most serious crimes. This increased the number of prison sentences, and penology became the important sector of criminal law science.

THEORIES OF REFORM ARE INADEQUATE

Since some offenders did not twice offend, and since confinement was a costly and difficult process, the idea of reform became conspicuous. For the past one hundred years the theory of reform has been dominant. Reform has generally been accepted, therefore, as the object of confinement. When confinement is not followed by a subsequent offense, it is credited with a cure, or reform. There are enough such instances to make the theory of confinement and reform appear plausible.

But in many instances the theory has failed. The first confinement has been seen to be only the first stage in a career of crime. Thus confinement has come to be looked upon as dangerous in itself, especially to first offenders. The failures, universal and persistent, have led to skepticism, and to analysis, and to a wide variety of the types of confinement and treatment.

PROBATION FAILS IN A LARGE PERCENTAGE OF CASES

An alternative is sought. The alternative is probation—a system of organized social control. We have now had probation a sufficient length of time to know that it, too, fails in a large percentage of cases, and seldom can safely be applied to the more serious fundamental felonies. Different criminals are seen to react differently to the same experiences.

Hence arose, finally, the effort to locate the secret of crime in the *criminal himself*. So came the study, understanding and classification of criminals, with the establishment of definite physical and mental types. Such a variance is found that reaction to any single standard treatment is impossible.

EVEN INFERIOR INTELLIGENCE DOES NOT FULLY EXPLAIN CRIME

Some individuals fail to respond favorably to any kind of treatment—probation, correction, reform or what not. Intensive study of these recidivists reveals defects both physical and mental. A considerable percentage of inferior intelligence is found among the repeaters, the unreformable. The conclusion has hastily been reached that low intelligence explains all crime, or at least all failures to reform. Further testing shows, however, that there are many persons who have average intelligence or better but who are criminals, and that there are many persons definitely feeble minded who never commit offense. So the feeble minded theory as a sole explanation of the recidivist fails.

THE CRIMINAL IS AN EMOTIONAL DEFECTIVE

Then came the discovery that defects of the emotions were conspicuous to a remarkable degree among the unreformable and dangerous criminals. Lack of normal feeling and emotion was found among those who committed brutal crimes, such as the fundamental felonies, robbery and burglary, homicide incident to robbery and burglary, and assaults upon women.

Here the cycle was completed—the early explanation of the criminal as a wicked or vicious person was reached again, but with added light, inasmuch as mental and emotional defects accounted for the perversity.

WHY HANGINGS DO NOT PREVENT MURDERS

Years ago, when I first went into the district attorney's office, I had very little knowledge of psychology. My course had been that of a high school, where we had studied Havens' "Mental Philosophy," a metaphysical psychology, where the writer told about the workings of his own mind and thought he was interpreting the minds of all mankind. I had a little more psychology in college, but it was about the same thing. I went to the district attorney's office, therefore, with the traditional view of the layman; that is, with the view held by crime commissions organized by business men in this country. And I thought the criminal was what he was because he did not want to behave. Remember, all my early life I had attended Sunday School, and had been walking in the straight and narrow path. So we punished the offenders again and again, and hanged a few—to set an example and to terrorize the others.

I realized the futility of our treatment of the criminal when we had fourteen in the county jail to be executed, and three more boys came in as the result of a murder. The state's attorney asked me if I would ask the judge if he could not sentence those boys to life rather than to death. He said, "We have fourteen to hang in the next two weeks, and the flow of blood will be a spectacle to shock the public." The judge sentenced those three boys to life imprisonment solely on those grounds.

What we found was that we were not succeeding in preventing murders in spite of the hangings.

INADEQUACY OF RIGHT AND WRONG TEST

The case that brought to me the full realization that these murderers were defectives was that of young Richard Ivens, who had killed Bessie Hollister, a choir leader in the Methodist Church. She was attacked on the public streets at 6 o'clock in the evening. A wire was put around her neck and she was strangled. The young man was at the police station. Unfortunately, I let another attorney cross-examine the witness. With my own training in the criminal courts, there would not have been any leading questions such as proposed. Hugo Münsterberg of Harvard University telegraphed our Supreme Court where the case was pending for a supersedeas that the youth was irresponsible, and that his alleged confession was untruthful. Later Professor Münsterberg in his book, "On the Witness Stand," claimed that the confession was false and that this youth was innocent. That was true, as I later informed Professor Münsterberg. I ran my fingers through the boy's hair and looked at him in pity. I told the state's attorney that the boy was feeble minded. He said, "I want you to try this case and I want you to try it with caution and care. The father happened once to be a neighbor of mine. He is a fine American." I tried that case with great caution. I sought to lead the jury to a life imprisonment, but the Supreme Court denied the supersedeas, and the jury executed him.

When a man like Hugo Münsterberg of Harvard telegraphed the Supreme Court, I thought it strange. We had alienists of our own who knew the right and wrong test, and they claimed that this boy knew right from wrong. But the boy was suffering from dementia praecox, which was not understood by the Chicago alienists at that time, or by the alienists of the world for that matter. When the mother appeared on the stand, I took a hasty look, because I have never cross-examined a mother trying to save her boy. She was not there long, but I could trace the source of the mental defect.

With longer experience with criminals and greater familiarity with experts in courts, I noticed that the professional expert who testified on the witness stand paid great attention to the state statute. He would say, "He knows right from wrong." That is the test in sanity in this and every state in the Union. But I noticed that men like Doctor Grinker, and other men teaching in the colleges, took a different attitude. They were not so sure about the accuracy of the right and wrong test. Some of them challenged it entirely.

I began to inquire into the subject. When we organized the Municipal Court I personally saw to it that forty-two sections of the law were changed. And so I took notice that the statute, which I had stood before juries and held to be as sacred as the Holy Bible, was made by humans. The legal tests for insanity have not been questioned since 1840. They represent, therefore, the medical opinion of that time. They are not the medical opinion of today. Hence, we see the great discrepancies that appear when experts take the witness stand.

For twenty years I have been at the head of the Municipal Court of Chicago, with thirty-seven judges. The Court has a large criminal jurisdiction in binding over felony cases to the Criminal Court, with final jurisdiction in misdemeanors. We have specialized the courts. We have one for boys seventeen to twenty-one years of age, the Boys' Court; another for girls of the street, a Morals Court; and for married people who cannot get along together we have a Court of Domestic Relations. We made this specialization on the theory, at the time it was instituted, that if one judge heard the family troubles of the people of a great city for a week, six months or a year, maybe in the total of incidents we might find out what was the matter.

We did not have to wait long before we found out that there were things the matter, psychological troubles, delusions of unfaithfulness on both sides; that many kinds of mental troubles lay at the bottom of family rows.

A PSYCHOPATHIC LABORATORY FOR STUDYING THE CRIMINAL

When we organized the Municipal Court, I realized that we would have in the Boys' Court many cases such as the one I have cited above. Watching them coming in constantly, for ten years, I noticed the physical, mental and moral deterioration of the "mine run" of cases. So I determined to open a psychopathic clinic. For ten years now we have had attached to the court a psychopathic clinic presided over by Dr. William J. Hickson, who was trained in the clinics of Von Monikof, Bleuler, and Kraepelin, in Europe. The court has as bailiffs all the members of the Police Department of the City of Chicago, so that seventy-five hundred policemen act as agents in bringing

into that laboratory those who do not conform to normal standards, and who commit crime.

These courts are placed in the central building where easy access to the psychopathic clinic can be had. The criminal branches are scattered about the city, some fifteen in number, and they send those who are suspected by the judge or the prosecuting attorney to the clinic for examination. Thus we have the largest clinic of abnormal psychology in this country, if not in the world. So that of this I can be sure, that there are very few anywhere who have had more experience with the half-man, as I call him, than I have had.

DEMENTIA PRAECOX THE CRIMINAL PSYCHOSIS PAR EXCELLENCE

Studying mental defectives from the psychological approach has enabled us to differentiate mental defects into two great divisions, namely, defective intellect and defective affectivity, and under the first division to subsume the following concepts: feeble mindedness, paresis and senile dementia; and under the other general division to subsume affective defects under the three concepts of schizophrenia (dementia praecox), manic-depressive insanity and epilepsy.

The judges send only suspected cases to our laboratory. Out of 779 cases in the Boys' Court, 654 were found to be suffering from dementia praecox, or about 84 per cent; 109 from psychopathic constitution, or about 13 per cent; and 10 from epilepsy, or less than two per cent.

In the Morals Court, out of 464 cases of females, 260, or 36 per cent, were dementia praecox; 92 psychopathic constitution, or 19 per cent; and 4 epilepsies, or less than one per cent.

Out of 359 cases of males in the Morals Court, 107 were dementia praecox, 110 psychopathic constitution, and 4 epilepsies.

Out of 657 cases of males in the Domestic Relations Court, 236 were dementia praecox, 295 psychopathic constitution, and 3 epilepsies.

In the outside criminal branches of 270 males, 107 were dementia praecox, 68 psychopathic constitution, and 5 epilepsies.

Out of 152 females, 84 were dementia praecox, 41 psychopathic constitution, and one epilepsy.

You will observe, therefore, that dementia praecox plays the highest rôle and is the criminal psychosis *par excellence*.

THE RELATIVE IMPORTANCE OF EMOTIONAL DEFECTS

This relative importance of the affectivity to intelligence, emphasized in case after case, has been a revelation to us. We found that defects of the basal ganglia, or the seat of affectivity, governed behavior more than defects of the intellect. The affectivity (emotion) is the gateway to the intellect, to the personality; it is the expression

of personality regulated by the intellect. We have found that a defective intelligence is a misfortune; a defective affectivity, or emotion, a calamity; but a defective intelligence *and* affectivity, a catastrophe.

Such affective deviation as is found in dementia praecox is plainly one of the most important rôles in our social, commercial and industrial life. It is important for lawyers and judges to appreciate this fact, in order to understand types of criminal behavior. It is especially important for the teacher to understand its significance, because she must get to the intellect *via* the affectivity. It is important to the eugenist, because he must get control of the affective factors in order to reach his aim.

Furthermore, a study of defective affectivity throws light on normals, as to their affectivity, which is more significant and dynamic than their intellects.

MINDS MAY BE INTELLIGENT YET EMOTIONALLY COUNTERFEIT

Besides the feeble minded, we have people of high intelligence who have poor emotions, and who are negative and pugnaciously retroactive. We even elect them to public office. In some of our cities, it seems, sometimes, that one needs an intelligence rating of only eleven or twelve years to be eligible. In one city a Congressman declared that the city needed no highbrow officials. In other words, mediocre intelligence, according to his idea, was what was needed to guide important public affairs.

Some years ago I was advocating a Crime Prevention Bill before a certain legislature. Committees were invited to discuss the proposition before the legislative committee. Among them was a man who wore a big sombrero, had a conspicuous crop of hair, and a negative disposition. Such headgear is, of course, normal in the West. It is acceptable, for instance, at the Agricultural College at Ames, Iowa, where it is the prescribed headgear. But upon the streets of a large city, where the wearer is the only one with that headgear, to say the least it attracts attention, and most people would think the individual a little bit off. This man—with the sombrero, long hair and the instinct to oppose everything—set out to attack my bill. He began by asking me to define dementia praecox, even before I had begun to talk to the committee. His associates requested him to desist, but I answered his question, adding that, besides the inward signs, there were outward signs of this trouble; that inward signs were displayed when such an individual opposed, without reason, everything everybody else proposed. The outward signs, I stated, were sometimes displayed by mendicants in the streets of our large cities who wore sombreros, and let their hair grow long.

My opponent sat down and quit examining me. He opposed my bill, but failed to defeat it. The bill was vetoed by the Governor. Then I came before the next session of the legislature. There was my opponent again, but with his hair cut. He asked, "Where do you think you are going to get now with your bill?" I replied, "The bill that you opposed was adopted by the Belgian legislature. It was adopted by the State of Massachusetts, also." He replied, "You didn't accomplish anything the last time you were down here." I said, "I certainly did, I got your hair cut."

And to this day this man keeps his hair short. Of course, in his case long hair may not have meant anything, but he was afraid that it did.

The persons of stunted intellect and moral defect are scattered all through society. They account for the greatest burden of educators, from the kindergarten to the university; they account for the carelessness, the irresponsibility and the quarrelsomeness that check industrial production. They account for some of the needless civil litigation and for much of the lying of witnesses.

EMOTIONS CONFINED TO BASAL GANGLIA

The intellect is primarily centered in the cortex of the brain. This cortex and the intellect have been pretty well explored. The emotions and the physical substrata, the basal ganglia, are practically *terra incognita*. Well-balanced and well-rounded pedagogy should be just as interested in the one side of the brain and its reactions as in the other; in fact, it should be more interested, if anything, in the side that up to the present has been so consistently ignored.

Now, you say, what are these basal ganglia? When we began in Chicago to talk about the basal ganglia, some of the alienists smiled. I can remember one alienist I met at a banquet. He told me that I would better sit at one side of the open window, "For," he said, "your basal ganglia will be affected." He was sarcastic.

One of the first things the Laboratory did was to recognize the important difference between the intellect and the affectivity, or emotions, as well as the fact that the intellect is primarily confined to the cortex while the affectivity is primarily confined to the basal ganglia of the brain. The Psychopathic Laboratory is without a doubt the largest clinic of abnormal psychology in the world. It is not surprising, therefore, that anyone properly trained in medicine, neurology, psychiatry, and psychology would stumble on to a certain amount of discoveries in this previously little explored field.

In Germany they knew more about these matters. Germany has been twenty years ahead of America in psychological and psychiatric studies. I could hardly believe it when I was told that, because I knew that we did better in surgery in the United States than they did in Europe. I knew we were nearly as good in internal medicine. I was not prepared for such great lagging behind, in our country, in psychology and psychiatry.

Our Laboratory has made quite a contribution to the hereditary and eugenical phases of the crime problem, also. In several of these fields, however, the Laboratory has had to stand alone and practically unsupported until more recent investigators have come along and confirmed many of our findings in a most unequivocal manner.

For instance, Dr. H. Steck, of Switzerland, in the *Swiss Archives for Neurology and Psychiatry,* in an article called "Contribution to the Psychic Sequelae of Encephalitis Lethargica" (sleeping sickness) says:

"We have seen that the association test has permitted us to find analogies with the schizophrenia (dementia praecox) and with the epileptic syndrome. We have found, in addition, katatonic symptoms, which are correlated with injury to the basal ganglia. In fact, we are able to say today with Fraenkal, Dide, Guirano, Lafage and others, that the katatonic symptomatology is in direct connection with and concentrated in the neighborhood of the basal ganglia. This not only accounts for katatonic motor symptoms, but also a part of this psychic symptomatology of katatonic epilepsy.

"Our observations as well as those of many others show that the psychic troubles consequent on an epidemic encephalitis are not of the nature of dementia but direct themselves to the affectivity. It appears here to concern itself with affective psychic troubles directly of an organic nature, and which are neither reactive nor secondary to the psychomotor. Staehelin has already attributed these affective disturbances to the basal ganglia.

"The principal aim of our study was to call attention to the analogy existing between the psychopathological syndromes already known, which are limited to the basal ganglia and which are responsible, in certain mental troubles, for the retarded affectivity and association disturbances of the epileptics."

He also says that Minkowski maintains in a recent article that clinical psychiatry is confined to but three concepts within the domain of the endogenous psychoses, namely, manic-depressive insanity, dementia praecox, and epilepsy, and these are coming to be recognized more and more as really qualities without transition of one from the other. Steck adds that it is just these three qualities more or less complete that we have found as the sequelae of encephalitis lethargica (sleeping sickness—lesion of basal ganglia).

This is an important discovery, that sleeping sickness leaves after-effects, just as sometimes does scarlet fever, and that conduct may follow similar to that found in epilepsy, in manic-depressive insanity,

and in dementia praecox. The similarity of symptoms led us to the discovery that the behavior is the result, in the case of sleeping sickness, of acquired injury to that center of the brain, whereas in the case of many of the criminals, it is found to be an hereditary characteristic.

DEFECTS OF BASAL GANGLIA HEREDITARY

There has been progress made since I was a prosecutor. In the first place, Mendel's law of heredity was re-discovered in 1900. That law, as you know, was discovered by Mendel in 1865. Then followed Kraepelin's great discovery of dementia praecox, a defect of the emotions, and their large play in the activities and behavior of human beings. Then came the discovery of the chromosomes, those minute particles that contain the traits that we get by inheritance. Here we find the whole story of human conduct, potentially, as traits in the chromosomes.

There are two schools of psychology in Chicago, one represented by Dr. Herman Adler, and the other by Dr. William J. Hickson of the Municipal Court. Doctor Hickson stands upon the rock of heredity, and thinks that environment plays a minor part in behavior in comparison with heredity. Doctor Adler, from his writings, seems to think the opposite. Environment furnishes the opportunity. Environment disciplines the character, but our studies and experience have proved that the fact of fundamental importance is heredity. And we now know it scientifically. We know it by the family history. We know it by the records of the brothers and sisters, of our cases, and by their uncles and aunts.

Many of the members of the Juvenile Protective Society organized by the women in Chicago have had great faith in environment as against heredity. The Juvenile Court, which had its origin in Chicago, was organized by a group of women who were concerned about the way the courts handled children. Nearly all our social workers in Chicago were environmentalists, and thought that by proper economic conditions, proper home environment and training, we could deflect from criminal ways those children who came to the Juvenile Court. Mrs. Britton from Hull House came to see me about the disorderly boys of the neighborhood. She said, "I want you to send an able, strong and forceful judge to Maxwell Street Branch Court." "What's the matter?" I asked. She said that the foreign children had grown wild there. "They are going in and stealing the pipes out of the organ. They are stealing the wire from the piano." I laughed. She said, "What are you laughing at?" I said, "I am laughing at heredity over-running environment at Hull House."

Now $1,337,000,000 of American money has been spent toward environmental objects, as against only about $50,000 for hereditary. And heredity plays the major rôle in conduct. Fortunately, every farmer, every stock raiser in this country knows the importance of heredity. I was shocked one day, when talking with Doctor Adler of Vienna about the coming to this country of Doctor Mjoen of Norway. "What does he talk about?" said Doctor Adler. "Heredity." "He is my enemy," said Doctor Adler. "What do you mean?" I asked. "I do not believe in heredity," he said; "heredity is a superstition." I said, "I wish you had time to go down to my farm. You would find Percheron horses. You would find, as head of the herd of Holstein cattle, a descendant of 'Mercedes, the 37th;' as head of the hogs, a descendant of 'Orion Sensation.' Everything on the farm from the dogs up is registered. Why? Because I have to go down and get a little encouragement in looking at good stock once in a while after seeing as I do in court so much neglect of the laws of human heredity."

WHAT THE FAMILY HISTORIES OF CRIMINALS REVEAL

The recording of external data fortifies the laboratory data. It is found that cases of low intelligence or of abnormal emotion, or both, are in most instances traceable to heredity. Instead of being a sporadic thing, appearing by chance in individuals, the accumulated case records show that, like all physical and mental traits, it runs in family stocks, and, like other characteristics, is subject to the laws of genetics.

During election they killed a man in Chicago. He was a member of a family that had one member who was feeble minded, another who was deaf and dumb. This boy who was killed was intelligent, but he had an emotional defect. He began early to take money out of slot machines and to misbehave as a child. He grew up and became a bootlegger. A policeman killed him. The Chicago police should have taken the man in for disorderly conduct. After the trial, at which his true condition would have been disclosed, he should have been put in an institution.

The young man who was tried recently in Chicago, twenty-six years old but mentally twelve years of age, who killed a little child with a hammer in an old abandoned barn, had a fact in his history that was not brought out on the witness stand. He had a relative who for forty years was in the Kalamazoo Insane Asylum. And that is one reason, in a recent case that you have read about, why the family had a doctor take the family history and present it to the court. When the plea of guilty was made, that family history was submitted. The highest priced alienist in the case refused to go on the witness stand unless he

could go back into the family history and trace the traits in the chromosomes of the defendant.

A BLEND OF HIGH EMOTIONS AND HIGH INTELLECT

Many laymen, as well as psychologists, have thought and written upon the significance of the emotions, but the most striking thing that I came across in looking through literature for recognition of the importance of the ethical or emotional side of man I found in the address of Phillips Brooks at Philadelphia over the body of Abraham Lincoln. He said:

> "As to the moral and mental powers that distinguished him, all embraceable under the general description of clearness of truth, the most remarkable thing is the way in which they blend with one another, so that it is next to impossible to examine them in separation. A great many people have discussed very crudely whether or not Abraham Lincoln was an intelligent man, as if intellect were a thing always of the same sort, which you could precipitate from the other constituents of man's nature and weigh by itself, and compare by pounds and ounces in this man with another. The fact is, that, in all the simplest characters, that line between the mental and moral natures is always vague and indistinct. They run together, and in their best combinations you are unable to discriminate, in the wisdom that is their result, how much is moral and how much is intellectual.
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> "You are unable to tell whether in the wise acts and words, which issue from such a life, there is more of the righteousness that comes from a clear conscience or of the sagacity that comes from a clear brain. . . . Not one of all the multitudes who stood and looked up to him for direction with such loving and implicit trust can tell you today whether the wise judgments that he gave came most from a strong head or from a sound heart. If you ask them, they are puzzled. There are men as good as he, but they do bad things. There are men as intelligent as he, but they do foolish things. In him intelligence and goodness combined, and made their best result of wisdom."

A sound intelligence and a sound emotion make a great brain. Lincoln had them both in a high degree. A statesman may have high intelligence, but low emotions. We find that some of our statesmen have not seen right from wrong when the difference was as wide as the road. They lacked that fine emotion that is essential to high moral acts. Thus we find evidence of moral defects sometimes in public office, on the part of our states' attorneys, our judges, our senators.

LINCOLN'S INTELLECTUAL AND EMOTIONAL INHERITANCE

Now, Abraham Lincoln has been held up to the American school children as the product of environment. They have talked about the Kentucky forests. They have talked about the Indiana and Illinois prairies. The woods of Indiana and the prairies of Illinois only disciplined his character. He was what he was by reason of a great heredity. He was one of the best-bred Nordics that ever lived. When he was President, he corresponded with a pastor of the church at Norwich, England, according to what Mr. Henry B. Bale, an insurance lawyer in Chicago, told me. He, when a boy, had lived in Norwich, England. At that time he had not read the inscription on an elaborate bronze tablet under one of the windows of that church, but upon returning with his wife to visit the Norwich church, he read it. He was struck upon reading that "Abraham Lincoln" had died there in 1640. This Abraham Lincoln was a great man of the district. While Mr. Bale was reading the tablet, the janitor came up to him and said, "I found an old booklet in the basement written by a former pastor of this church, when your Abraham Lincoln was President of the United States."

Mr. Bale read the pamphlet, and noticed the correspondence between President Lincoln and the pastor. It seems that this Abraham Lincoln of the great monument, that must have cost a large sum of money for those days, had three sons, Abraham, Mordecai and Thomas. One of these sons came to America with the second trip of the Mayflower. The other one came a few years later. Descendants went to Pennsylvania and Virginia, and Thomas, the son of Abraham—all the same names: Thomas, Mordecai and Abraham—was the father of our Abraham.

We know through the chromosomes that traits can miss a generation, can miss twenty-five generations, yet can come out at any time. This Abraham Lincoln of ours had a great ancestor in a man who was a dominant character of the region and of the century. He was honored above all others of that region. Our Lincoln's father was an important person down in Illinois. He was educated for those days, and in a pioneer community, as shown by his reports of sales in court records. You must realize that a man in a pioneer community had not the opportunities that he might otherwise have had. Environment furnishes opportunities.

Our Abraham Lincoln was what he was, therefore, by his breeding. That the children should be told, because this idea that Lincoln could come from scrub human stock is negatived by the fact that scrub stock cannot produce a Lincoln. It cannot, it never has, and never will, under the laws of heredity.

FINE EMOTIONS A QUALITY OF LOVABILITY

This same quality of emotional tenderness, which Lincoln had, may be present even in a feeble minded child. To illustrate the difference between high intellect and high emotions, many feeble minded children have sound emotions. That is why they are lovable, that is why they are tractable, that is why they are obedient—often many times more so than some normal children—because they have fine emotions.

Of the last twenty-one murderers in Chicago who were executed, everyone of that total had defective emotions. These the law did not consider or contemplate because science has outrun the law. One of them, Church, killed Daugherty, the Packard salesman, and threw his body in the river. Also he buried the body of Asmus, another salesman, beneath the garage floor. In order to obtain possession of a five-thousand-dollar Packard car, this criminal lured one of these men into his basement, and a little later, the other, and murdered both of them. This murderer was a youth from Adams, Wisconsin. When he was tried he was conscious. After his trial he became unconscious, and remained so for forty days. The jury decided that he was normal and knew the difference between right and wrong. The jail physician called in our doctor to see if he would live to be executed. He found him rigid and unconscious. The eyelids could not be opened unless pressure were applied. The body was rigid. His feet were cramped. The toes were each folded over the other toward the big toe, and held in such a cramped position that it was next to impossible to move them the least bit. A match was drawn across his body, and the line would stay in the flesh and show for hours. He was a typical case of dementia katatonia with catalepsy, a common sight in the wards of large insane asylums.

What should have been done? The schools of Adams, Wisconsin, ought to have identified that boy when young, and have incarcerated him in a segregated farm colony.

A TEST OF EMOTIONAL QUALITY

I was down in Washington visiting a friend. He has two children, one five, the other three. The father said to me, "They are intelligent, but I am worried about whether or not their emotions are right. Can't you tell me?"

I looked around to see if I could find some experiment. I noticed the boy loved his cat. Also, I noticed an axe out in the entry-way. I took out a watch that chimes, and rings the hours, minutes and seconds. I said to him, "Do you like that watch?" He looked at me with suspicion. He was too smart to believe that I was going to give him the watch. I rang it in his ear. "I will trade the watch for your cat,"

I said. I put it to him while the chimes were ringing to hurry him to a conclusion. He said, "All right." I gave him the watch. He gave me the cat.

I went into the entry-way, picked up the axe, and started walking out. The father said, "Where are you going?" I said, "I am going out to the wood pile. This is my cat. I traded the watch for it. I am going to chop the cat's head off."

I got clear to the door, and that boy did not budge. I wondered honestly how I would get my watch back. I was soon rid of my worry, however, because the boy came bounding with the watch. He said, "Here's your watch! Give me my cat!" And so I gratefully took the watch and gave him the cat.

The emotional quality of that boy had protected the life of the cat. He was young enough to think that I might cut the cat's head off. He did not propose to have any blood on his soul, even of the cat.

I remember another boy who was three years of age when he came to America. I once saw him carrying a tomcat by the tail. He slammed its head against a stone foundation. Though only three years old, he had mastered the cat by cruelty. The boy has since served time in the penitentiary.

We find that a great many of that type commit crime. I undertake to say that crimes of violence, what the lawyers call fundamental crimes, such as robbery, burglary and assaults upon women, are the acts of those who are both intellectually and emotionally defective. You will find all combinations or grades of feeble mindedness and of dementia praecox—that double defect. Of all the robbers and all the murderers I have seen, I have never seen one that I did not think answered that description. There may be a normal murderer, as a result of a quarrel, when a man kills another in hot blood, or a man kills another in self-defense. And there may be occasional crimes when a normal boy gets mixed in bad company. But the fundamental crimes of violence are committed by mental and emotional defectives.

The great McDougall, whom the English released to come here to take the place of Professor Münsterberg at Harvard, is a leading authority on heredity, psychiatry and psychology. He had an article in a recent *Forum* in which he called attention to the great wave of crime throughout the United States. He said that crime runs parallel to mental deficiencies in the American population. I find that to be exactly true. That is the experience of the lawyer of long standing in the courts. So that we have here a neurological problem, as well as a criminal problem.

THE GREATEST MENACE FROM IRRESPONSIBLE DEFECTIVES

Irresponsibility is the quintessential unsocial characteristic of both general classes of defectives, the morons and the psychopaths. The competent members of the community have to guard these defectives, endure their depredations and make good their waste—often doing all these things without being fully aware of the burden or the cause for it.

Now what is the great menace from irresponsibility at the present time? Obviously it is the easy reproduction of the unfit. The majority of competent men and women are putting rigid limitation upon the number of their offspring. It is the natural reaction of their sense of responsibility. The defectives have as much instinct for reproduction as normals, some of them much more. They lack, however, the normal's innate inhibitions against easy and rapid reproduction.

And what has society done in the face of this threatening situation? Has it made it difficult or impossible for defectives to propagate? On the contrary, society has devoted itself with frenzied zeal to the encouragement of the propagation of the unfit. It has done this in both indirect and direct ways; indirect by placing no bar to the union of the unfit with one another or the union of the unfit with the fit; direct by exerting itself in every conceivable way that nature and science can suggest to keep alive every child born to the unfit, and to feed and develop every such child until he or she is old enough to reproduce (excepting, of course, the imbecile and the idiot).

THE MAGNITUDE OF THE PROBLEM

If we look at the criminal statistics of our country we see how large the problem is. Take note of the fact that our asylums are being filled. In Illinois the asylums are full, the feeble minded institutions are full, and we are building more. In Illinois now, 25 per cent of all our taxes go to the asylums, and to the feeble minded and charitable institutions. If we add to that the cost of crime, half the entire taxes of the State of Illinois go to the mental deficiency problem. And that is probably true of every state in the Union.

This large group of institutional cases is not the whole story; it is only part of it. The twilight group, between daylight and dark, constitutes as serious if not as pressing a problem. I do not think we need to institutionalize all the feeble minded. I think some of them can live in the communities if they are kindly treated, if the normal children are taught to be kind. If a feeble minded boy goes to school, the children all get around and shame him to tears. "Crazy, crazy," they yell in derision. In Ireland they teach the children that bad luck will come to them if they make fun of a

feeble minded person. When I went to Tangiers, I noticed that everybody was kind to the insane and feeble minded. I made up my mind that if ever I was going crazy, I would go to Tangiers. Kindness to these unfortunates is a part of the Mohammedan religion. They are taught that a good spirit resides in all insane.

IDENTIFY THE CRIMINAL BEFORE HE COMMITS THE CRIME

Can we handle this great problem? Yes. I think that the Juvenile Court, the Boys' Court, and in lesser degree the Criminal Court, can be eliminated when we can identify these defectives in the public schools, and remove them to protected farm colonies. Good psychiatrists can identify them when they are babies. The testing of large numbers of offenders in a consistent manner, and the possibility of segregating the unreformable type, have been proved by records of conduct. These have shown that prognosis can be based upon laboratory data.

As I was coming into court one day, a man said to me, "I am the son of the man who plastered your house." "What are you doing here?" said I. "This is my wife, and this is the baby we are going to adopt. That is the mother of the baby." Here was a mother giving up her child! Immediately I suspected mental deficiency, and began to talk to her. "What is your father's business?" "He is dead." "What did he die of?" "He died in the insane asylum." "What is your husband's business?" "He's a dirty drunk, and in jail." Here was bad heredity on both sides of the child. So I looked at my friend. "You don't want a court paper. You come up with me to the laboratory." I took them up there. The child was defective. The doctor, by special tests, diagnosed that child as both feeble minded and a dementia praecox case, the type that is often executed in the big cities of the country in later years for murder. The doctor persuaded them not to adopt the child, but to turn it over to an infant asylum.

Thus high skill in diagnosing these defects, especially those of the emotions, makes it possible to ascertain in advance of the commission of crime that the individual is likely to break down under temptations that normal persons invariably withstand.

To permit these defectives to have "one chance," and thus to start them on the treadmill of crime and restraint, is no kindness to them. And since their history is practically always one of minor offenses committed at an early age and more serious ones later, it is not a practical program to postpone diagnosis and treatment until the objective symptom of violating the law is observed.

In other words, we must subject criminals at an early stage to examination, and sort out those having typical defects, placing those who

combine intelligence defect with emotional defect under permanent restraint before the age for serious crimes is reached.

LET US SAVE THE DEAD MEN

I am often asked, "Don't you believe in hanging?" Jim Daugherty, a reporter on the *Tribune,* said, "Judge, I don't understand your position." I said, "Jim, are you married?" He said, "No." "You haven't a wife?" "No." I said, "We will assume you are married and have three sons. One of them is behind grade for age, is defective and commits murder, and he is going to be sentenced to death. Let's go to the hanging of Jim Daugherty, Jr." Jim said, "I'm game." I said, "Jim, you can afford to be. There is no such boy or wife, but suppose it were a real fact." He said, "I don't understand your position. What objection have you to the hanging of my son?" I said, "I am the man he killed."

That is why I objected. "I think society ought to have cared for your boy before he killed me. That is my theory. I do not care to be dead."

Before every murder trial we have a dead man. Let us save the dead men and get the murderer *before* he murders. That we can do by preventive measures. He should be picked up in the schools. The potential criminals can be recognized. They are behind grade, obstinate, quarrelsome and troublesome. They are the more serious problem children.

I once saw in the laboratory such a little boy. I tried to become friendly with him. He would not let me. Mrs. Hickson said, "Johnny, will you not please pick up the ball?" referring to a ball that she had dropped near him. Finally he stooped under the table, and when he thought no one was looking, he kicked it farther away. Negativism. We see it, also, in some of our statesmen.

IMPERATIVE NEED OF FARM COLONIES

There remains seemingly but one effective method of crime prevention, and that is to segregate the defective delinquents in state controlled colonies where the protective environment that they need can be created. Under such control there is an abrupt end to criminal depredations and to reproduction. Both great needs of society are met. The need of the individual defective is likewise met, for he is given an opportunity to live to the limit of his powers, whatever that limit may be in each individual case. He has all his worries and troubles removed. Existence is no longer an anguish and agony for him, but a sensible balance of work with play.

These farm colonies for defectives are soon to be common enough. They will be in operation long before people generally realize the mo-

mentum that real race suicide has gained. Such colonies will greatly reduce the cost of the defective to society generally and to the state. For the defective will be able to pay his way when given proper restraints and wise management. And other institutions, which are well intended but which have practically failed because defectiveness was not understood, will be relieved and permitted to accomplish some good.

EXPERTS NEEDED

The greatest limitation today upon immediate entry on such a program is, not the lack of public understanding or the inertia of legislatures, but the inability to produce on short notice the psychopathic experts who are qualified to sort out and to classify the subnormals. It will take some time to provide the teaching staffs necessary and to turn out such experts.

PUBLIC OPINION WILL CHANGE

There will be no lack of the needed public opinion by the time the new type of alienist is provided in sufficient numbers. And by that time the need for stopping the poisoning of the racial stream will pretty thoroughly be understood. Enormous revenues are required for the maintenance of insane asylums. This line of expenditure increases faster than any other, and yet there are more insane at large than in asylums. It lies within human power, though the complete ideal may never be achieved, to prevent insanity and defectiveness to such a degree that an outspoken case will be as rare as a case of leprosy.

These modern sciences also affect our religion. Religion has been much concerned about the future life, but these sciences will direct it more and more toward the future of our race. Our responsibility to the race, to the unborn children of tomorrow, will be a larger and larger part of our religion. The human being of the future cannot have a better inheritance unless we begin now to bring about the application of scientific laws. We are beginning to have a racial consciousness. The church will help because its members are usually among those who have the finer emotions. I look for the church to lead even in the eugenic reforms.

THE IMPORTANCE OF SOUND IMMIGRATION LAWS

Along with the sturdy stock that we have taken into the country has come a considerable amount of defective stock. The restriction of immigration of the defective type too long has been delayed in this country. Doctor Mjoen of Norway in a recent address in Chicago told of a defective from Poland who came to Denmark, married and left six or eight children; went to Norway, married, and left several chil-

dren; proceeded to Sweden, married again and had several children. He returned to Denmark, where proceedings were instituted to deport him and he was ordered to leave the country. One of the Danish newspapers ended an editorial, protesting against such immigration, by the statement, "Denmark is at last rid of this undesirable citizen." "But," replied Doctor Mjoen, "Denmark is not rid of him. Denmark, Norway and Sweden have twenty-five of his children mixed in their population to carry on through their defective heredity the damage this one man did to those countries." The significance of the blood stream in our national life is emphasized by such an example.

THE NECESSITY OF CONTROLLING MARRIAGE

Sound immigration laws are necessary in order to keep the blood stream pure, but they are less important by far, in the making of the future America, than the matter of who, among those now on this continent, shall become parents of the countless millions born in the next few generations.

Wiggam has pointed out that one-fourth of each generation (which is one-eighth of all people born) produces one-half of the next. In the next generation this half produces three-fourths of the next, and ninety-eight per cent of the next, so that the quality of the original one-fourth, whether high or low, soon determines absolutely the quality of the whole.

Have we any regulation of marriage? No. Should we educate the young people? Yes, to know the importance of heredity in marriage. If we taught this in the high schools, we would have as the idea behind the contemplated marriage, instead of the almighty dollar, whether or not any of the relatives were in the insane asylum or in the feeble minded institution or the penitentiary. Traits break out in any family. They may come down, as I say, from the chromosomes as remote as twenty-five thousand years, and certainly from one hundred, or fifty, or twenty-five. They can appear at any time, under the chromosome theory. So that an occasional defect is the burden of the race and not of a particular family.

Psychopathic surveys of definite districts in New Jersey, New York, Indiana, Minnesota and in other states in recent years, have proved the tendency of subnormals to mate with their kind. They multiply more rapidly, under the protected environment that modern society so generously provides, than do normal stocks, which subject themselves to severe limitations. This thing is going on in every state and every city, worse perhaps in some places than in others, but capable of spreading like typhus or plague from place to place.

There have always been defectives and defective stocks, but until quite recently the environment of Northern peoples was so harsh and rigorous that the defective stocks tended constantly to be uprooted, to be bred out. The defectives had much the higher mortality rate, especially among infants. Now we find the ordinary conditions of a century ago, to go no further back, absolutely reversed. The normals have cut their rate of reproduction and at the same time have actually invited defectives to multiply freely, with a guaranty that their offspring will be coddled and nourished and protected and brought by every artificial means to an age when reproduction instincts will provide another generation.

So, at the present time the defectives are multiplying as never before in the entire history of the race. A great part of the earnest and zealous thought and effort of the community is bent upon enabling this degenerate stream to become wider. The limitation of offspring has foolishly been called race suicide. It is not. Race suicide lies in the encouragement of the unfit.

ALTERNATIVE METHODS OF CRIME ELIMINATION

Of course Nature in time will supply a corrective, if we are not clever enough to restore the equilibrium by conscious action. But Nature's cure will mean a loss of what we call civilization, and a return to old conditions of privation and rigorous living. When neither normal nor defective will have any hospital or asylum, but both will have to shift for themselves in a relentless struggle with natural forces, as was our history through countless ages, the unfit will again diminish and the fit will be restored to their rightful ascendency.

It may be that this is the only way. Some of the alternatives are frankly unthinkable. We cannot deliberately reproduce the hardships of life that our forefathers fought and subdued. We cannot withdraw from the unfit the benefit of medical and surgical aid, the lying-in hospitals, the free clinics of a dozen kinds. We cannot avoid protecting them from infectious diseases, from unwholesome food, from the depredations of their own kind and from the wiles of the profit-seeking and ruthless. For our own protection we have to keep them and their offspring well. We cannot solve the problem by making over all our cities into a protective environment so that the defective will have no opportunity to steal, for with a policeman on every corner and no saloon anywhere there would still be just as rapid reproduction as ever.

We cannot do what our ancestors did at a not remote period—put to death every incorrigible criminal. That would help us out to a considerable extent, but it is impossible. We cannot deport our undesirable stocks. We have not been able thus far to keep other countries

from unloading on us. We cannot unsex all our defectives. That would be the easiest, the cheapest and the surest method; it would purify the life stream in a few years. But public opinion will not at this time sustain such practices on a scale commensurate with the need.

A knowledge of the danger of a non-eugenical marriage is, therefore, of the utmost importance because the highest value in this world is a sound mind in a sound body. A sound mind in any kind of a body is of course a good asset in life. The soundness of the human stock makes for the success of this as well as of the future generation; it makes for happiness.

CIVILIZATION AND EVOLUTION NOT KEEPING ABREAST

We have only begun in this field, of the new psychology, which has revealed that the basic trouble causing bad behavior is not defective intellect alone but defective emotion. The intellect itself plays a minor part.

The intellect of man has developed latest in evolution. The emotional brain, the cerebellum, is that inherited from the animal kingdom of millions of years ago. It is older, and therefore there are probably less defects of that brain than of the intellectual brain. In other words, there are more people with sound emotional reactions than there are with high intelligence.

It is a good thing that that is so, because that is the only reason why Democracy, as we conceive it in this world, can exist. With a sound emotional reaction, you have sound morals. You can trust the moral instincts and judgments of a people more than you can trust their mental judgments. That is a fortunate thing for Democracy.

But civilization can go forward while the human race deteriorates. Civilization is the accumulation of the inventions and experiences from generation to generation. The advance of civilization and the advance of human quality are not necessarily parallel.

With knowledge being extended by the rapid development of communication, so-called civilization will proceed with greater rapidity than ever before. All minds of competence will be applied to many problems. Progress will be accelerated also by the accumulative discoveries of science and their application to life. It will be harder to live in the civilization of the future than it has been to live in the civilization of the past. A better mind, a mind more highly evolved, will be required to meet the emergencies of life and of the times.

Then, too, the backward races of the world are adopting the ways of science and of Western civilization. There are close to 1,500,000,000 of the colored race and only about 500,000,000 of the white race. The

white race has held its own by control of the forces of science and by control of the sea. We need to conserve and to improve the white race, as well as to see to it that other races breed from their best, because we have to live in this world with them, and the world is getting smaller and smaller. We need to check the reproduction of these defective strains and breed a higher average of man and woman in order to keep up with this advance of civilization.

OBSOLETE CRIME LAWS SHOULD BE REVISED

Crime prevention is seen, finally, to be the weeding out of defective stocks, and thus to be a part of an eugenics program. Being most readily discovered, and most universally abhorred, crime control is the first step in such a program.

Crime prevention becomes, then, the concern of the public school teachers, the biologists, psychiatrists, the medical profession in general and intelligent lawyers and statesmen. When the problem is attacked by these forces, laws will be enacted embodying modern scientific knowledge, the enforcement of which will give the legal profession and the courts a new and better opportunity to curb crime.

As it is, the legal profession and the courts are dealing with laws obsolete from the scientific aspect. Not only does the legal profession necessarily lag behind scientific discoveries, but as Professor McDougall says, also it lags behind public opinion.

The functions of the courts today are the enforcement of statutes that are far in arrear of medical opinion. Then, too, American courts have been influenced by the opinions of English courts, in dealing with insanity, when these English courts were not abreast of science. As late as 1862 the Lord Chancellor of England, in the House of Lords, declared that the "introduction of medical opinions and medical theories into this subject of insanity has proceeded from the vicious principle of considering insanity a disease." Our laws now deal with the criminal largely on the basis that he is a normal person who knows the right yet prefers to pursue the wrong, and that this perversity is due to bad environment and an inadequate education and insufficient discipline. For example, the test of responsibility for crime where insanity is involved was laid down in 1842. That continues to be the test in most states up to the present day.

Occasionally an American court has gone beyond the right and wrong test and held that one may not be responsible for a criminal act even if he has a knowledge of right and wrong. In Parker v. State, 81 Alabama, it is held that one may be irresponsible.

"(a) If, by reason of the duress of such mental disease, he had so far lost the power to choose between right and wrong, and

to avoid doing the act in question, as that his free agency was at the time destroyed.

"(b) And if, at the same time, the alleged crime was so connected with such mental disease, in the relation of cause and effect, as to have been the product of it solely."

This decision was rendered by Judge Summerville more than thirty years ago. From that day to this it has been a leading case, first, because it was in conformity with our experience, and, secondly, because it was in conformity with scientific facts discovered since it was written. From the brief submitted in that case, I assume that the judge was influenced by the German Code, concerning the responsibility for crime, which was written by the great Kraepelin. Paragraph 51 of the German Code reads as follows:

"There is no punishable act, if at the time of commission the actor was in the state of unconsciousness or of morbid disturbance of the mental faculties which excluded the free determination of his will."

It will be seen from the text of this paragraph that the question of guilt is identical with the question of mental soundness. The distinction made in statutes between insanity and other mental defects should not have been made. All mental defects should be considered in fixing responsibility and punishment. Laws have taken into account mental defects where the emotions have been exaggerated, that is the *hyper*-emotional, because the defect was patent to the layman, but have ignored the mental defects in which the normal emotions were lacking, the *hypo*-emotional. Medical science has advanced since 1848, and until legislation catches up with scientific advance, the courts will not be safe against crime waves.

LEGISLATION NEEDED TO EXPRESS MODERN SCIENTIFIC OPINION

The direct route out of this legal *impasse* is by legislation that expresses modern, scientific opinion. For securing such legislation, the education of the lawyer and the judge is likely to be very helpful, if not absolutely requisite. It is hard to conceive of any legislature enacting an adequate law until the lawyer members have been shown that the facts back of the law as it is are not what traditionally they have been assumed to be. And unless the judges of the highest courts get a more correct understanding, there will be danger of ignorant and hostile interpretations of the law, thus defeating its purpose.

What we may call an indirect way of modernizing the law is by judicial decision. We can hardly expect courts of review to take the initiative. It is conceivable that some supreme court may before long acquire a scientific conception of the problems lying beneath the trite

terms of "criminal intent" and "criminal responsibility," and may deliver an enlightened opinion that will re-establish the law in conformity with our present-day learning. But in order to bring this about, it is almost necessary for lawyers to comprehend the subject and to conduct their trials in the light of science. That would enable them to do two useful things: (a) Get the needed facts in the record, and (b) brief the case in an informative and convincing manner.

The impending change may come through legislation, or it may come through judicial decision. Education is needed on all hands to speed the day when the belief that insanity is a disease will not be looked upon as a "vicious principle." That our courts of review are not being apprised of the actual situation in regard to the mental defects of defendants appears often in reported criminal cases.

ENVIRONMENT AND HEREDITY NEED ADJUSTMENT TO ONE ANOTHER

Biology, psychiatry and psychology are new sciences. They have hardly been considered sciences for more than forty years, while the physical sciences have behind them centuries of application. I have no doubt that these modern sciences, when applied to the human race, will work greater changes in our civilization than have the physical sciences.

Our educational system will be the first to be affected. Not all those who apply to the college for admission should be admitted. Psychological tests will direct the youth in the lines that they should follow. This was illustrated by the experience of the Rochester University School of Music. Doctor Rhese, the President, and Mr. Eastman, the benefactor of that university and the supporter of its music school, insisted upon using the Seashore test for musical ability in testing all applicants. The entire faculty opposed, but Doctor Rhese and Mr. Eastman had their way. The tests were applied. At the end of the year a check-up was made of those who actually failed in the school with the reports from the psychological tests made at the beginning of the year. One hundred and forty-six had failed—and the one hundred and forty-six who had failed were the ones who failed in the psychological tests. After this demonstration the faculty gave in, and the psychological tests for ability in music became a permanent requirement at Rochester.

Industry will apply these tests. There certainly is need of them. A few years ago I sat upon a coroner's inquest in Chicago where a freight train has backed into a street car and killed ten people and injured thirty. The railway towerman looked suspicious to me, and I caused him to be examined by Doctor Hickson, who testified that he was nine years of age mentally and had dementia praecox in addition. He re-

mained in the tower, notwithstanding the cries of the dying and wounded beneath. He had no emotional reaction toward their plight and no urge to help. This conduct of his, as well as his appearance, enabled me to identify him. It cost the railroad large sums in damages to have employed a mental defective in so important a position.

HUMAN DESTINY IN HUMAN HANDS

You may think the eugenic program difficult and almost an impossible one. It is more popular to sing with Henly, "I am the master of my fate, I am the captain of my soul," than to follow the other doctrine—which is the true one—I am not the master of my fate, I am not the captain of my soul. None of us is responsible for his heredity. The best we can do is to study our inborn capacities and guide our lives along the indicated lines. Some men are selling ribbons who should be commanding armies. Some could be great engineers who are selling life insurance. The schools did not find their capacities. Environment and heredity need to be adjusted.

After all, the real significance of this work is not confined by any means to what we started out to consider—the problem of crime. The quick and certain diagnosis of defectiveness in a number of definite classes is an addition to human knowledge and power that transcends such a limited field as criminology.

A deep concern for the future must prompt us to effective measures of control. The task seems beyond us. There are, however, measures not difficult that will bring results in a generation. Among them are these things that I have stated we can do. We can, by appreciating the biological factors involved, educate our young people to the importance of proper mating. We can restrict marriage so that the defective, the insane, and the criminal may not multiply. We can deflect from the public schools dangerous defective types to protected and humane farm colonies before they come to the Juvenile and Criminal Courts. Also, we can adopt sterilization.

By these methods we can reduce our taxes one-half. We can make the conservation of human resources the high aim of government and society. We can cease to make the individual the unit of society. We can make the family the true unit of society and by promoting racial hygiene increase the prestige and soundness of our nation.

In these directions, it seems to me, our attention must be given if we are to preserve and improve the quality of our national stock and thereby keep the American nation foremost in the family of nations. The future belongs to that nation that soonest and most effectively enforces a sound biological program.

To this cause we must give our allegiance. Private citizens of means, foresight and love for their fellowmen are investing in education and research in biology, psychology and psychiatry. We must promote general public information along these lines in order that wise legislation may be enacted, so that the unborn children of tomorrow may have a good inheritance. When the public understand the need and possibilities, and realize that to a much greater extent than we have heretofore known human destiny is in human hands, they will further a biological program with a zeal that characterizes religion, and set an example in our country that will redeem the world from many of its greatest afflictions.

THE CRIMINAL IN EVERYDAY LIFE

Dr. William J. Hickson, Director Psychopathic Laboratory, The Municipal Court of Chicago, Ill.

Most of my time is spent looking into the faces of criminals, or to be more correct, of abnormal individuals, so that it is always a pleasure to attend such meetings as these and to look into the faces of normals for a change.

I have brought from the Laboratory a collection of weapons that have been removed from my clientele. I hope you will not have occasion to make any closer acquaintance with them in the hands of the latter. You will see here all kinds of revolvers, including toy pistols; also various kinds of knives, clubs, blackjacks and other contraptions, including poison. These are the implements of the criminal's calling, his tools of trade. Many of these weapons are of curious and primitive fabrication; they resemble very closely the instruments used by primitive people that were shown on the screen by another speaker earlier in the evening. Many of these instruments in our collection show considerable industry and ingenuity, of a kind, although well-made and better implements are readily procurable. The nascent prosecuting attorney sees in these only a fine example of premeditation, while the psychiatrist sees unmistakable evidence of insanity and irresponsibility.

The criminal seems to be quite generally *persona non grata;* no one seems to desire his friendship. Nobody cares to have close contact with him. On the contrary, most people try to keep away from him as far as possible. Consequently there is very little general comprehension of his real nature.

This lack of understanding of the criminal is a costly piece of ignorance for all concerned. While at first flush he is not a very wholesome or interesting subject, when we consider his cost in terms of taxes, insurance, destruction of life and property, disturbance of the peace and dignity of the community; cost in time and money of business men serving as jurors; anguish; kakogenics, and all the other evils that trail him as camp followers—such as questionable bondsmen, "fixers," etc., to enumerate only a portion of his harmfulness—it is seen that the criminal looms up as a very important element in the complex of civic life, about as important as cancer in the physical life of the race.

It costs about $1,500 per year to take care of one of the proteges of the Juvenile Court in a juvenile institution; in fact, it costs as much

for one juvenile delinquent in a reform school as it does to send a student to Harvard.

Even at this high cost, if results were obtained, such expenditure might be justified, but the cure for the underlying defective constitution of these unfortunates remains to be discovered.

HOW HUMAN WEEDS CHOKE OFF THE GOOD PLANTS

There is a saying in finance that good money drives out bad. This is not true of humans. Here the bad drive out the good. The good cannot compete on the underworld's level. The strong conquer the wilderness, make it easy and safe for human habitation, and then the noxious human weeds spring up, multiply proliferously, and choke off the good plants.

Up to a certain ratio between them the better-endowed, responsible element can direct the poorly-endowed, but there comes a time when the former are so outnumbered that the latter assume the ascendency and we see them crashing through by sheer weight of numbers. They drag down standards and where they cannot pull them down to their level and cannot make the grade of the professions, etc., they create parasitic, substitutive, mock professions, mimicry. Thus we see the various medical cults, the "fixers" about the courts, the religious cults, some of the so-called primitives in art, the deterioration of the press, etc., veritable cults of incompetence.

WE ARE STILL IN THE DARK AGES OF CRIMINOLOGY

That we do not understand the criminal is evidenced by the fact that, up to the present, we have practically ignored him and his background, and have devoted all of our attention to the inanimate, passive part of the phenomena, the crime. And, we have been trying the same methods of eradication of crime for two thousand years or more with only utter failure from these methods, which, at once a gigantic effort as well as a signal failure, amount only to a senseless gesture. If we understood the criminal, we would not persist in our present long-proved inadequate objective methods for his eradication. The subjective method of approach would at least be tried.

The courts are maintained for repeaters. They make up the bulk of the cases tried—a sad commentary on our present system. It is not uncommon for a girl to have been in the Morals Court a hundred times or more. One girl has four hundred and twenty-five arrests to her credit. The Domestic Relations, Criminal Branches and Boys' Court are relatively as bad. If medicine persisted as blindly in such a reactionary way, we would still have plagues and epidemics. If Doctor Kellogg, here at the Battle Creek Sanitarium, did not do any better for

his patients than our courts do for theirs, we would not have this wonderful institution.

WHEN ANIMALS WERE TRIED FOR CRIME

A hundred years or more ago the insane were similarly misunderstood and misjudged, and treated as irrelevantly as the criminals are today, just as a hundred or more years before that animals and insects were tried and punished as criminals. Responsibility was ascribed also even to inanimate objects, such as stones, clubs and knives that were used as weapons, called the law of Deodand.

The depth of ignorance, superstition and mental defectiveness, manifested by such odious blunders, can be matched even today by our similar attitude toward criminals. Future generations will look upon us with the same astonishment and commiseration as that we have for our predecessors.

A century or two ago it was not uncommon for the family and domestic animals to live under one roof, and it was not an unusual incident, under such conditions, for a pig to eat a baby. The pig would be arrested, indicted for murder, and lodged in jail to await his trial, it being an unbearable offense. And to show no invidious distinction, the sheriff would charge as much per diem for his keep as for his human fellow-prisoners.

He would then go to trial with all the pomp and ceremony that those fallow days commanded. The learned judge would appoint a counselor to defend the prisoner. The counselor would resort to every known technicality in trying to save his client from the gallows. The prisoner would then be tried by a jury of his peers, and, if found guilty, would be sentenced to death by the judge with the greatest possible solemnity and duly executed at the hangman's corner.

Another very common culprit of those days was an ox. If, as often happened, he gored a man to death, he was tried with all the trappings and panoply incident to that age of deification of the law and its minions. The corner hangman often found such condemned oxen anything but docile and repentant victims of the *lex talionis* of those days. In one instance, in carrying out the mandates of the law, he attempted to bind the legs of an ox with rope, but the conscientious prosecuting attorney, who was on hand according to law to see that the decree of the court was properly enforced, objected to the ropes, saying that "the law demanded that such condemned individuals must be hanged naked." The sheriff, observing the letter but not the spirit thereupon, hacked off the limbs of the ox, and the execution went off uneventfully. Justice was done.

In one of the public buildings at Geneva, Switzerland, there is still to be seen a bas-relief commemorating the majesty, if not the intelligence, of the law—portraying such an execution.

The sadistic ingenuity of mankind has been exhausted in devising methods of punishment for crime. Some of these methods have been so revolting as not to bear mentioning, in these days of civilization. Much of this applies, likewise, to the treatment of the mentally disordered in the dark ages of insanity. The dark ages of criminology we have still with us today (albeit somewhat attenuated) in the dark and noisome cells of the penitentiary, with their starvation diet, suspension of the thumbs and wrists, fire-hose treatment, etc.

CRIMINALS ARE DEFECTIVES

"To know all is to forgive all." The criminal is a human deviate. It takes special training and tests to understand and evaluate him, but until such understanding becomes general, so that proper measures to fit his particular case can be promulgated, we shall continue to have the criminal, like our poor relatives, always with us.

I am not holding a brief for the criminal, but I am holding a brief for the people who are going to be robbed, who are going to be raped, who are going to be ruined, and who are going to be killed by these same defectives. The average large city daily is a record of the performance of defectives. Defectives are one of the most prolific sources of material for such dailies. The readers are unwittingly reading such material of deviates from the normal run of individuals as though it were news of normals instead of clinical records. In other words the abnormals in the communities are furnishing the reading matter for the normals. The more insane, the better the copy. Watch the papers from day to day and study the array of crime, the ravages of these defectives. You and yours may be next!

The direct correlation between the criminal and mental defectiveness first was forced on my attention over twenty-five years ago in the mental and neurological clinics, and later in my work in institutions for the feeble minded and insane, both in this country and abroad. I found, in carefully going into the cases, a high incidence of criminality in the family histories of the patients in these clinics and institutions. Also, in the case and family histories of criminals, I found a high incidence of insanity and of feeble mindedness. Time and the criminal himself have been our great allies in proving our case, that criminals are defective and incorrigible. They always continue to perform; they never fail us.

THE SPAN OF INTELLECT AND OF EMOTION

One of the first things of importance we discovered in this field was the distinction between the intellect and the emotions, and the significance of each as reflected in behavior. The intellect is passive, the affectivity or emotions active.

The innate intelligence runs from zero to twenty-five years, with the average of the community testing about twelve and one-half years. These are the workers of the community. Twelve and one-half years may strike some as a rather low level, but when one takes a concrete case, such as a normal boy about this age who tests up to his age, one finds that he has a very broad and useful sphere of activity in the community. It would seem a wise provision of Nature that there are these various levels, to fit the various types of work.

The dead-line on the intelligence side below which one is not able to get along in a community is ten and one-half years. I discussed this with Doctor Simon in France, one of the originators of the Binet-Simon Scale, and he informed me that that is the minimum of intelligence necessary to function on the outside, and then only in a very simple environment and with supervision.

The emotional span runs from the one extreme, where an individual lies with all the appearances of death, up through the phlegmatic individual, then the normal group, gradually running over into the erethistic type of individual, up to the extreme case, at the excitable end, who is so hyper-emotional, hyper-affective, that he is constantly agitated, extremely busy, yelling, screaming, talking a gibberish, or in other words the very opposite of the man at the other extreme end of the scale.

It is now possible by the aid of tests to make a quantitative affectivity scale along the lines of the intelligence scale. School records should contain scorings for both scales in scholars' reports. Both scales are necessary for proper advice in vocational training, etc.

The normal individual is found midway between these two extremes of affectivity. Those who are under-emotionalized are called hypo-emotional, those over are called hyper-emotional.

The great body of workers are recruited from the middle group on the intellect and emotional scales.

We find teachers complaining about their phlegmatic pupils and their overactive, mischievous ones. These are borderland cases from the lower and upper side of the emotional scale, respectively. If the teacher had the proper test on these cases, which she should have when they enter her class, she could then work much more intelligently and with less friction. Where the children have good intelligence, they

are the cases, on the one hand, of which the teacher says that she knows they could do the task if only she could get them interested and they would try; and on the other hand, those that she knows could do their task if they would pay attention and concentrate.

A man may have high intellect but inadequate emotions and consequently be a failure, or a man may have a comparatively low intellect but good emotions and be fairly successful in certain lines not calling for a high grade of intellect.

No mental rating is complete unless it gives the emotional or affective as well as the intellectual quotient, or whatever other way such measurements are expressed. The emotional or affectivity is the most important of the two. It activates the intellect; it is basic to fully 90 per cent of our daily behavior.

One of the most important recent advances in psychology is what is called Gestalt psychology (configuration or structural psychology). It is contributing considerable new light on our mental processes that, among other advances, is leading to improvements in our mental tests. It has shown the importance of the ripening of the intellect versus use in the learning, and that there is an optimum period in the development of the mind of the child when it learns with the greatest economy of time and effort.

THE INTELLECT IS STILL YOUNG—THE EMOTIONS OLDER THAN THE SERPENT

Apropos of the intellect and affectivity, it might be mentioned that these are the two main divisions of the mental make-up. The intellect is phylogenetically the younger, and is located in the cortex of the brain, what is known as the cerebrum. The cerebrum first makes its appearance in the animal scale with the reptilians. Some rather unkind people think that many of these reptilian characteristics still persist. The affectivity is located in the phylogenetically older part of the brain, known as the basal ganglia. The affectivity is basic to about 90 per cent of our daily behavior. As Pascal says idiomatically, "The heart has its reasons, which the reason knows nothing about" (*"Le coeur a ses raisons que la raison ne connait pas"*).

THE POSITION OF THE CRIMINAL WITH RELATION TO THE INSANE

The negative or inadequate side of the affective scale, and its connotations, is the indirect contribution of criminals to science. It was discovered during the examination of large groups of criminals, thereby bringing to light a corresponding group of deviates on the negative side comparable to the group of deviates on the positive side, which is the commonly recognized form of insanity. We now have to learn,

therefore, to accustom ourselves to this other group, who make up the bulk of our criminals.

And it would be just as absurd to punish the positive group of insanities in penitentiaries as it is absurd to handle the negative group as we do.

SCIENTIFIC CLASSIFICATION OF MENTAL DISEASES

A fundamental grasp of mental affectivity is now available through the discoveries of the relation of the basal ganglia to mental defects.

Mental affections may then be classed in the following groups, based on the underlying anatomical localizations: The intelligence defects in the cortex, the emotional defects in the basal ganglia.

MENTAL AFFECTIONS

PRIMARILY— *Intelligence Defect*	PRIMARILY— *Emotional Defect*
1. Feeble Mindedness	1. Dementia Praecox
(a) Idiot (Low Grade	(a) Simplex
(Middle "	(b) Hebephrenia
(High "	(c) Katatonia
(b) Imbecile (Low Grade	(d) Paranoides (Paranoia)
(Middle "	
(High "	
(c) Debile (Moron) (Low Grade	
(Middle "	
(High "	
2. Paresis	2. Manic-Depressive Insanity
(a) Juvenile	
(b) Adult	
3. Senile Dementia	3. Epilepsy

Heredity is found to be a check here. For example, in the disorders of the basal ganglia, it is found the same syndromes are manifested from generation to generation. Formerly, before their psychological and anatomical relationships were discovered, it was believed, for instance, that manic-depressive insanity would appear in one generation, dementia praecox in the next and epilepsy in the next, and this was very hard to account for until the newer discoveries threw light on the underlying common factors of all.

CORROBORATIVE NEUROLOGICAL EVIDENCE

Defect of certain areas of the cortex also manifest themselves in quantitative and qualitative alterations of the neurological reflexes. This is important corroborative evidence of certain mental disturbances, and it is also very objective. There are likewise accumulating data on the neurological reflexes due to defect of the basal ganglia. This is important, likewise, as the criminal lawmakers have a deep-seated complex against recognizing the emotions. They sense here

their nemesis. But with such objective data they cannot much longer ignore the existence of defective emotions as the basis of crime, and as ground for mental irresponsibility.

"MENTAL FINGERPRINTS"

An important advance is the recognition of the relation of what is known as the three extra-pyramidal systems of the basal ganglia of the brain, and their relation to the emotions. There is also being developed a considerable neurology of this latter system, the same as we have it of the pyramidal system. In the latter we have the tendon and Babinski reflexes, and on the other hand we have the inner and outer *rand* reflex, *schutz* reflex, hypertonia and tremors, etc.

It is interesting to study the latter on our various tests, especially what we call the mental fingerprint, or a mental autograph test. In order better to bring out the various tremors and motortonus disturbances, we have our cases draw and write with their left hand, as well as with their right. This technique also brings out other tremors that sometimes would remain undisclosed, as with alcoholics. The forthcoming Annual Report of The Municipal Court of Chicago will contain illustrations of this technique.

RELATION OF GRADE OF DEFECT TO TYPE OF CRIME

In the vast majority of cases the defective emotions determine the criminal, while the level of intelligence determines the nature of the crime. A good intellect may offset a slight degree of emotional defect, and a good emotional make-up may help overcome a slight intelligence defect.

Given a certain degree of emotional defect, the low and middle grade moron is the petty thief; the high grade moron, the hold-up man; the low and middle grade sociopath, the yegg-man; high grade sociopath, of average intelligence, the check forger and confidence man.

Where there is a slight emotional defect, we see the feeble minded fall into crime occasionally, due to this and to their defective judgment.

We encounter cases of paresis—an acquired disease in which the intellect is primarily involved—who, having an exuberant emotional make-up, launch large enterprises, make colossal purchases, issue checks wholesale without funds to meet them, etc., due to judgment becoming defective; or those of a depressed emotional make-up who become suicidal.

In certain kataklonia varieties of schizophrenia, called also manic-depressive insanity, the affectivity becomes so active that the victim is under high pressure mentally and physically and in the acme of it may launch all sorts of gigantic schemes day after day. Under this

pressure, he may issue worthless checks and often forge public and other documents, etc.—all in the uncontrollable pressure of his hyper-emotionality. We have recently had two cases in one day of this type. One was a woman of high social standing who passed into this hyper-emotional condition and ran up big bills, issued worthless checks, etc. We committed her. The other case was an ex-judge, who started all sorts of gigantic enterprises without any adequate foundations, forged public documents, etc.

Given a case without a criminal record, who at about the period of senescence forges documents, we may regard this as pathognomonic of the manic phase of so-called manic-depressive insanity, as much so as we regard rusty sputum as pathognomonic of pneumonia. Paretics in the grandiose phase do relatively similar acts, but the concomitant symptoms differentiate them.

Criminals with good intelligence attract more notice because of the type of crimes they perpetrate. The average person does not know that their criminality is due to their defective emotions, in spite of their good intelligence. These cases know right from wrong, but due to defective emotions such knowledge is not sentient.

INTELLECTUAL AND EMOTIONAL LEVEL HEREDITARY

Our mental make-up is predetermined at birth.

The intelligence is static, and the emotions are dynamic. We can therefore do very little with altering the quantity of the intelligence, its level being hereditary, but indirectly we can influence it qualitatively, to a certain extent, through the emotions. The emotions, being dynamic and fluid, lend themselves better to a certain degree of influencing, and where the emotional make-up is not very much disturbed, we can exert a certain amount of influence over it. Good emotions may help out a poor intelligence, but the reverse is not true to the same degree.

This situation has had a ray of hope brought into it, however, as the data are accumulating that the brain cells depend for their development on the secretion of certain glands. The thyroid gland is one of these. A child born without a functioning thyroid gland remains a dwarf and feeble minded. Glandular substance fed to such a child during the developmental years will result in the customary mental and physical development. Other glandular substances are now being discovered that may result in the eradication of mental defects of children born without such functionary glands, due to inherited defect.

CRIMINAL POTENTIALITIES ARE MANIFEST IN EARLIEST YEARS

Due to the fact that mental defectiveness is inherited and constitutional, it manifests itself quite obviously in the earliest years of life,

hence, most criminals come in conflict with environment in the Juvenile Court age.

Not only does it manifest itself there, but also in their school life and other contacts. For instance, only 15 per cent of the boys in the Boys' Court finish public schools, whereas the general average is 85 per cent. Many of our cases fail to finish not only because of intelligence defect but because of affective (emotional) defect, having enough intelligence but not the adequate affectivity successfully to apply it.

HEREDITY VERSUS ENVIRONMENT

According to the claims of the environmentalists, environment must be something that is contagious, like the plague. If you are immune you will not contract disease, and if you are normal, you will not contract criminality. Perhaps a preventive vaccine may be discovered by them. They claim that if you place a boy in a bad environment he will become a social problem case, a criminal; that if you place a bad, anti-social boy in a good environment, he will become a good, industrious, law-abiding citizen. This is indeed a very simple formula for solving one of civilization's most serious and chronic problems, one of its greatest handicaps, the ravages of the anti-social individual.

Experience and science teach us quite the opposite from that the environmentalists claim. If we move defectives to a decent neighborhood, they make a slum of it in a few months. If normals move into a slum, they make a decent and livable place of it in a short time.

If the defective child is adopted into the finest kind of an environment, he will still be a defective and asocial. We have seen a case where a couple had two defective children who were asocial and had adopted a child who was normal, and the latter was good and industrious though all three were raised in the same environment. The reverse is, however, the common experience of adopted children of bad heredity, for in spite of the finest care and environment they turn out asocial.

The Municipal Court of Chicago, with its specialized branches—such as the Boys', Morals, Domestic Relations, Bastardy and Delinquency, School Court and Criminal Branches—offers an unusual opportunity for studying such cases *en masse*, permitting a concentrated study of the factors involved in these various groups of human maladjustment. It is through these studies that we have a "Who's Who" of about 50,000 criminals.

Apropos of those listed, it should be noted that you cannot make a criminal out of a normal boy any more than you can make a normal out of a defective. Once a criminal always a criminal; once a prosti-

tute always a prostitute. There is, however, a group of borderline cases that make up the occasional criminal. These are the cases that under certain stresses and strains succumb, but that, with a certain amount of moral and other support from the outside, may be able to go along after a fashion. This is the group that should receive most of the attention of the social service agencies. Time and money spent on those in the hopeless group is not only wasted but diverted from those who might be helped by such aid. The most such agencies can do for the hopeless group is to see that they are segregated as soon as possible, in this way to relieve the community of their embarrassing presence and at the same time to stop their propagation and thus fulfill our obligations to forthcoming generations.

CRIMES OF STATE RESULT OF PRESENT RIGHT AND WRONG TEST

The right and wrong test, the prevailing test for criminal responsibility in this country and England, is an anomaly, and is largely responsible for much of the discrepancies in the testimony of expert witnesses. A defendant may be medically and logically insane and irresponsible, but legally sane. The majority of the insane in the asylums could be hung as responsible, by this test, as about eighty per cent of them are there because of emotional defect and only about twenty per cent for intelligence defect, which latter might come under the right and wrong test.

The crimes of State, the legal murders that have been perpetrated in the name of this anachronism, are horrifying, yet subsidized alienists step forth for the State and line up with the hangman. They become veritable prosecutors. One feels that if some of these had not been physicians they would have been hangmen. The daily papers found it worthy of comment when one of these appeared in a case on the side of the defense.

These same types are always partisans; in fact, the whole procedure in such case is often one of medical and legal partisanship. The prosecuting attorney usually depends on the percentage of convictions for re-election. This does not tend towards impartial trials. Hence many communities have had public defenders appointed to protect defendants from such sinister influences. To appoint a public defender is a reflection on the prosecutor. Under the present postulates, however, it might be well to be honest and practical, give in to the system that is innate to this form of government, face the facts, and divide the duties of the prosecutors' offices, establishing a prosecuting and a defending staff. This has much to recommend it.

However, all is not indifference and hopelessness. Conscientious judges come to the bench and see these repeaters before them, boys and girls who have been through the Juvenile Courts several times,

who are now further along the crime road, at the half-way house, the Municipal Court (the next step is the Criminal Court), and such judges are rebelling at playing with justice in this manner, at being a partner in this farce, at repeating the failures of their predecessors, and hence are calling for help.

THE GUILT CONCEPT IS PASSING

In dealing with such defectives, the only logical attitude we can take toward them is one of commiseration. We have as yet taken no steps for the prevention of such defectiveness. Consequently we are, to that extent, guilty of a misfeasance, of really criminal neglect. The most we can honestly say to such defective delinquents is not, "We are going to punish you" (the guilt concept becoming more and more *passé* as knowledge increases), but, "Because of your defect it will be necessary to segregate you as long as that defect is dynamic." In most instances this will mean for life.

HOW TO RELIEVE THE CRIMINAL SITUATION

A crying need for the relief of the criminal situation is the transfer of criminal law, and much of civil law, as well, to Science, in the department of biology.

Another crying need is laws that square up with the facts of life, based on the scientific data of biology and not on the vestigial remains of the Dark Ages, superstition, ignorance and speculation.

We need humane farm colonies in which to isolate the unfit before they perpetrate atrocities, and where, being isolated, they will be prevented from propagating their kind.

We need prophylaxis in law as well as in medicine.

PSYCHOLOGICAL APPROACH SHOULD REPLACE CLINICAL

Another need is the development of psychiatry in the United States, where it is at a very low ebb. There is great need that experts be trained in the psychological approach to mental disease rather than the clinical, or at least that the clinical psychiatrists be trained also in psychological diagnosis.

As it is now, the clinical psychiatrists must depend in a large percentage of his cases on such fortuitous circumstances as happening to be present when the case "performs," or depending on hearsay evidence (many times contradictory from different sources) and the reports of lay social workers that are many times questionable due to the numerous potential sources of error in information garnered in this way. These erroneous data are filed in many central bureaus, and follow the unfortunate victim to his prejudice as long as he lives in

the community and comes in contact with any of the social agencies working in conjunction with such bureaus.

In the majority of cases diagnosed by the clinical approach, the case itself is quite ignored. The diagnosis is made by laymen—or what amounts to practically the same thing, by the reports of laymen —and the proceeding is reduced to a mere referee-ship as to who is telling the truth or whose reports are at all trustworthy, and with many cases to decide daily. Such clinical methods also require periods of time lasting from several days to weeks. They necessitate locking the patient up to have him under observation, which is doubly doubtful as a wise procedure if the case turns out to be normal and is discharged. One clinician, in a public discussion on the subject, said it took him months, sometimes, to make a diagnosis, yet this man was in an important child's clinic.

The large group of so-called negative insanities, the moderate katatonias, which comprise most of the criminals, escape the methods of the clinicians. Often the paranoiac will dissimulate under clinical observation.

The psychological approach is most efficient at detecting dissimulation. In this method of approach, all the extraneous, indirect masses of lay observation, gossip, scandal, etc., are ignored. The case himself is examined. What could be more logical. The tests are taken of the case just as the Binet-Simon and similar intelligence tests are made. In a couple of hours, by such tests, one may learn fundamentally more, in the vast majority of cases, than in several months of mere observation. The tests can be interpreted by anyone trained in this field, and hence, if all psychiatrists were using them, would once for all dispose of differences of opinion—now unfortunately so common among psychiatrists under the clinical method—just as the Binet-Simon and similar intelligence tests have eliminated the differences of opinion that formerly existed in the field of intelligence.

NEED OF A REVISED CRIMINAL CODE

All the reforms we propose will require appropriate legislation. The initiation will have to come from this country. European countries are still too stricken as the result of the World War to do much thinking along these lines. There is, however, much clamor all along the line for such reforms from those who have given the matter thought, and the field is not entirely barren of bearing fruit.

Several European countries are now in the process of revising or codifying their criminal codes, but with the exception of Italy there is no enlightenment shown.

The German Code has, however, introduced a new clause, in the paragraph on Criminal Responsibility, which permits the judges to moderate penalties where there is mental defect present, though not sufficient to relieve from total responsibility. It was this idea that was applied in the Loeb-Leopold case—mental defect not sufficient to justify lack of mental responsibility, yet of sufficient degree to be considered as a mitigating circumstance.

As a matter of fact, of course, both of these cases were so outspokenly insane as to justify any open-minded jury to find them irresponsible, but, as we know, the very rich and the very poor fare unjustly in our present methods of court procedure. The diagnoses and behavior of these two cases since their incarceration fully confirm diagnoses made at the time of the trial—as do the diagnoses and behavior of so many other cases—of mental defectiveness and irresponsibility, in which cases the State with the aid of alienists tries to get a hanging.

AS TO CAPITAL PUNISHMENT

The attempt to justify capital punishment on biological grounds is inconsistent, unless we carry it out all along the line on similar defectives in the early days before they reach the courts. Such ideas have prevailed in the past. The Greeks developed a superior race, physically, by exterminating deformed infants. They missed the main point, however, by overlooking mental defect, with the consequence that the mental defectives with their well-known prolificacy eventually overran the constructive elements of the community by their sheer weight of numbers, culminating in the devastation of the nation. If this country is not to go the way of these former great States, which were pulled down from within by their defective elements, it should begin without delay to take this situation in hand.

The new Swiss Criminal Code will abolish capital punishment in all its cantons. The few backward cantons that up to the present have had capital punishment now see the light. The canton of Zurich has in effect some of the most enlightened legislation along the lines of modern criminology in Europe, but it is not fully in operation yet, due to lack of proper institutions.

A NEW SPIRITUAL MAGNA CHARTA

The newly proposed Italian code has gone further than any of the other new codes now under contemplation of adoption, and is a veritable document of spiritual emancipation, a new Magna Charta of the spirit, more important and far-reaching than the first one. If it is adopted, it will strike a final blow at the mental thraldom and tyranny

of the guilt concept, the by-product of ignorance and superstition. This code discards the question of criminal responsibility and guilt entirely, and gets down to the sane and practical basis of the fitness or misfitness of the individual to function in society. The code would have been more scientific, sounder and more complete if it had evaluated more fully the significance of the ultimate mental factors as the basis of such unfitness. It is too tinged with socialistic feelings. But, even as it is, it is the first blow at the tyrant guilt concept.

It is unfortunate that the commissions that drew up the other proposed criminal codes did not have the integrity and fortitude to follow the truth wherever it led and gradually to produce codes in keeping and squaring up with modern scientific knowledge, for it will be years before these codes will be revised again. In the meantime these unfortunate countries will fume and struggle, trying to fit a square peg into a round hole.

We will conclude this article by quoting rather extensively from the introduction and conclusion of this code:

REPORT AND PRELIMINARY PROJECT FOR THE ITALIAN PENAL CODE

The defense of civilized society against crime must be carried out by repressive measures, in addition to what wise foresight will provide for in the way of prevention. These measures must, with penetration and discernment, be fitted to serve a twofold aim:

For occasional offenders who are not impelled to criminal courses by base motives (and these form the most numerous class), it avails most to apply humane methods of treatment that have power to preserve them from relapse and that facilitate their rehabilitation and speedy return to useful cooperation in civil life.

For offenders of a truly habitual character, those measures serve best that are fitted to detach from the body of honest citizens these perverted elements, which exercise therein a fatally disintegrating and corrupting influence.

The insufficiency of the laws now in force to attain these lofty and arduous ends, confirmed by the experience of thirty years, shows the opportuneness of submitting them to a wide revision, in order that the defense against habitual delinquency *may be rationally coordinated with the general system which lays chief stress upon the personal conditions of the offender* in addition to the materiality of the criminal act.

In the Report prefixed to the Royal Decree, the main lines to be followed by the Commission in its labors are traced. *Mention is there made of the dangerousness of offenders and the punishableness of their acts without reference to imputableness.* . . . .The degree in which a criminal act offends against the laws of corporate civil life *is not to be measured by the imputableness of the author but by his fearsomeness or dangerousness.*

Hence the President of the Commission, in replying to the Minister's remarks in that same Session, defined precisely the task entrusted to the Commission itself as follows: "This charge may be summed up thus: To

put forward proposals for a practical reform of the penal statutes inspired by the principles and by the methods of social defense against crime with references above all to the dangerousness of the offenders."

And he added that the labors of the Commission should be regulated by two guiding principles:

The first is that to avoid the inconveniences already experienced in Italy and abroad from attempting reforms that are fragmentary and often contradictory, those that we shall propose ought to respond to one general direction and one organic system which, as the report says, lays chief stress upon the personal condition of the offenders in addition to the materiality of the criminal acts. That is to say, our business will be to transfer this stress of the penal law from the crime to the criminal.

The second guiding principle is that the reform proposed by us must attempt the guarantee of individual rights with those of social rights. We shall accomplish a progressive work, consolidating the irrevocable conquests of modern civilization regarding the judicial guarantees of the three protagonists of penal justice. These are the criminal, society and the party injured by the crime.

THE OFFENDER INSTEAD OF THE OFFENSE

To guide and adapt the provisions of a law towards the offender rather than towards the offense.

This does not necessarily exclude the taking account of the objective criminal fact, whether as a preliminary juridical condition in order that a provision of law may be applied relating to a prohibited fact and that the wheels of penal justice may be set in motion, or as a mark of greater or less dangerousness in the author.

Even when the penal law padelix is inspired by the two fundamental principles of social defense and the dangerousness of the offender, the juridical problem will in great part remain unaltered in its practical daily explication.

In fact, for any criminal proceedings the initial problem consists in collecting, weighing and deciding upon the proofs in order to establish: One, that the fact has been committed; two, that it constitutes an offense, provided for by the law; three, that the accused has been the author of it, or has participated in it.

For the solution of this triple juridical problem, the prominence given to the personality of the offender will be an effectual help (together with the special and technical psychological knowledge of the penal judges); also for the objective and subjective appraisement of the proofs.

But it is above all in laying down the legal norm that the offender must take chief place, since its application to the condemned man is the end of the legal norm, it being presupposed that the criminal fact has been committed by the accused. Hence this attestation, which is the point of arrival for the criminal proceedings, is, on the contrary, the point of departure for the work of the legislator.

Here lies, in truth, the first decisive innovation in that "fundamental principle of the right to punish" which Carrara justly said "should be defined first of all by the penal legislator before applying himself to the work of

drawing up his code, to the exigencies of which right to punish he should maintain obedience at every step he takes."

Italian Criminal Law, elevated to the dignity of a science by the glorious schools that from Cesare Beccaria come down to Francesco Carrara and Enrico Plassina, has above all developed theoretically and practically, as a juridical anatomy of crime, considered as a "juridical entity constituted by the contradictory relation between a fact and a law."

And when also the person of the offender had necessarily to be the object of theoretic or legislative rules, he was always considered (as Mancini said when speaking in Parliament on the project for the penal code now in force) "as under a bell of glass;" i. e., uprooted from the condition of his physical and social surroundings, and not studied in his real organic and psychic constitution, or in his relation to certain well-determined exceptions to the presumption of moral imputableness, consisting of infirmity of mind, minority of age, deaf-mutism, drunkenness, subjection to the will of another, legitimate self-defense, state of necessity, impulsive anger or grief through unjust provocation.

On the scientific initiative of Cesare Lombroso and others, there was added to this juridical anatomy of the offense the methodical observation of the offender in his organic and psychic constitution.

Every offense, before being an entity or a juridical connection, is the work of a man. And to this man, and not to the objective fact, must be applied the repressive measures set forth by the law. And it is also this man who, after serving the condemnation, will continue to live either respecting the rights of others or committing fresh offenses.

Experience, especially in the nineteenth century, has shown that to the progressive improvement, whether of the traditional and classical criminal doctrines and their derivatives, or of the laws inspired by them, corresponds in every country an increase in criminality, not only as a reflex of changed social conditions, but in particular as an activity of special categories of persons (habitual offenders, minors, etc).

So that there has ripened in the public conscience the conviction, expressed in the decree which has set up this Commission for the reform of the penal statutes, that such a reform should in great part consist in carrying the objective of the legislative norms from the offense to the offender.

THE DANGEROUSNESS OF THE OFFENDER

Consequently the provisions for social defense against delinquency must not so much be adapted to the objective gravity (greater or less) of the offense, as has been done till now by the penal law of every country, as to the greater or less dangerousness of the offender.

As a matter of fact, a grave offense may be committed by an offender but slightly dangerous, while a light offense may, on the contrary, be the symptom of an abnormal and highly dangerous personality. And, since the judges have before them a man and not an objective fact, a contrast often arises in their consciences and in their sentences between the law and the human reality, and their judgments do not carry public approval because deemed too rigorous or too inadequate.

Hence the fundamental criterion for a reform of the laws on social defense against criminality must be that the repressive measures should be

more severe, i. e., more efficacious, for habitual offenders and those more dangerous through congenital or acquired tendency, and less rigorous, i. e., more adapted, for the great majority of occasional offenders, those less dangerous. For the former the repressive measures should undertake above all to hinder the repetition of their criminal acts, though without raging against them as if they were wild beasts, by separating them from civil society. For the latter the aim should be specially to re-fit the condemned person for returning to society as an industrious and no longer dangerous citizen.

And so, while the penal laws of antiquity and the Middle Ages, yielding to the psychological illusion that punishment is the remedy for evil, had shown an obstinate and ever-increasing penal ferocity against all offenders without distinction (and often even against the least dangerous), the modern penal laws, on the contrary, in obedience to the generous impulse of the classical criminal school for the defense of the "rights of man" against "the tyranny of the State," went to the opposite extreme of an ever-growing mildness, even when confronted with the most dangerous criminals. Whence it is that the principle followed by the Commission, according to the greater or less dangerousness of the offenders, re-establishes the equilibrium in the defense of society against criminality, and thus promises to make it more effectual and more useful in practice.

This distinction among offenders according to their dangerousness is derived from the fact that their anti-social activity is determined by congenital tendencies owing to atrophy of the moral sense, or by psychopathological conditions clinically diagnosed, or by passionated impulses, or finally by the prevailing influences flowing from the family and social surroundings, and from the defects of the penitentiary systems which become hotbeds, as it were, for the culture of criminal microbes. And it is only through this distinction and psycho-anthropological classification of offenders that the legislator will be able to realize in practice, by means of the repressive sanctions, the double purpose of social defense and the correction of the condemned, which the penal systems hitherto adopted have not been able to attain, because thought out and applied from an external regard to the diverse gravity of the offenses instead of being brought into intimate connection with the diverse personal conditions of the offenders.

LEGAL RESPONSIBILITY

From the two methodic criteria in virtue of which penal justice should have for objective the defense of the members of society against criminal aggressions (instead of an unrealizable retribution of a moral fault that has taken concrete shape in crime), and that the measures for social defense should be adapted to the dangerousness of the offender, there is necessarily derived a conception of penal responsibility radically different from the traditional one which, despite successive attenuations and compromises, still constitutes the informing principle of the Italian Penal Code now in force and also of the most recent projects for penal codes in other countries.

* * * * *

Having thus expounded the guiding criteria to be observed for the preparation of a new Italian Penal Code for delicts, and after having explained the reasons for the structure and for the single provisions referred to in this Project, wherein are contained the most fundamental and characteristic norms of the whole penal law, the Commission has the honor of presenting this Project to the Honorable Minister.

The Commission reserves to itself the presentation, before long, also of the proposals connected with the reform of Book II of the Code and of the other Penal statutes.

Given the adoption of the two principles of the *social defense* (as a State function exerted through penal justice) and of the *dangerousness of the offenders* (as the chief objective and guiding criterion for the provisions intended for social defense), which the Royal Decree, in constituting the Commission, laid down as the main lines on which the penal reform should run, this Project could not be other than a radical innovation, as compared with all the penal laws now in force. It comes indeed to challenge, on the practical ground of the legislative norms, the theories and the proposals supported by the positive school of criminology, which up till now had been criticized as unfit for any juridical system.

It corresponds, however, not only to a methodical complex of observations and scientific doctrines always more and more diffused from Italy to other countries, but it also corresponds to the thirty years' experience of the results obtained from the administration of penal justice under the provisions of the law now in force, and it corresponds to the modern public conscience, moral and juridical, which is being formed, and which, through scientific doctrines and practical experience, is gradually taking its orientation from the two fundamental principles of this reform.

Since, as Maudsley noted in regard to the treatment of the insane, "history proves that practice survives a long time after the theories which inspired it have lost credit among men," in like manner, for the treatment of criminals, penal justice has remained up till now, especially as regards the fundamental part of the laws enacted, in the same atmosphere as the ancient laws of Manu. In those laws it was said: "To aid Kings in their functions God created from the beginning the genius of chastisement; chastisement governs the human race; chastisement protects it; while it sleeps chastisement keeps watch; chastisement is justice."

With this Project the terrible, but necessary, function of penal justice, after so many millenniums of torture and horror and after one century of relative mitigation, has been brought into a different atmosphere, an atmosphere no longer of chastisement and affliction, but of a treatment more effectual for the defense of the social body from the most dangerous offenders, and of a treatment more humane, and socially more useful, for the less dangerous offenders.

As was said by Van Hamel up till now men have been made acquainted with penal justice; from this time forward the aim must be to make penal justice acquainted with men.

With the fundamental norms of this Project, penal justice not only comes near to the realities of the world, individual and social, but—in confutation of the preconception that the method of Galileo would systematically materialize it—on the contrary, it is spiritualized thereby, and is placed

in more continuous and profound accord with the moral conscience, because it places in clear light and in the first line the subjective conditions of the offender. Indeed, through it the motives determining to action are given a higher value, while, confronted with these, the material and accidental effects (e. g., the attempt) are given a lower value. Every way of escape from responsibility for one's own acts is cut off. The victims of the offense are protected by a more effective and rapid reparation of the damage suffered. The victims of juridical errors receive indemnity. Provision is made for the subsistence and social re-training of minors. Humane treatment is used, not only towards lunatic offenders but also towards habitual offenders and those who are most dangerous, while rendering more secure their segregation from society. Ordinary offenders are distinguished with precision from social-political offenders. The house of labor, the agricultural colony and the school-ship are substituted for isolation in cells during the day. Through work and training provision is made for refitting the greatest number of the offenders who are less dangerous for a life of freedom and industry. Their struggle with life's difficulties on returning to freedom is guided and protected. The State function of the Councils of Patronage and the Fund for Amends take the place of the old police methods, "admonition, supervision, compulsory domicile." Finally, a more effective defense is carried out against the degenerate, the abnormal, the incorrigible, and a more sapient and clement defense, reaching to pardon, against those who have fallen rather by misadventure than through perverseness.

* * * * *

When the project of Zanardelli for the Penal Code, which became that now in force, was under examination by the Chamber of Deputies, in the sitting of June 7th, 1888, Pasquale Stanislao Mancini declared that "the positive school of criminology, through its studies and researches as to organic and birth defects, and the influences exerted by social surroundings and economic conditions . . . instead of looking at the offender as if he were under a bell-glass, was worthy of praise." Shortly afterwards at a sitting of the Senate, November 13th, 1888, Jacopo Moleschott acknowledged that the pioneers of the positive school "kept scattering the seed without caring whether or not they would gather the harvest, and were planting trees which would give shade and fruit only to their great-grandchildren."

The initiative of Ludovico Mortara, by the nomination of the Commission undersigned and the laying down of the fundamental principles contained in the Royal Decree constituting the Commission, of date September 14th, 1919, has made possible to be seen what might be the legislative applications of these studies and these researches, what might be, from that seed, the harvest of penal and social justice.

STERILIZATION IN CALIFORNIA

A Study of Patients Coming to California State Institutions for Sterilization Only

PAUL POPENOE.

Since 1909 California has been practising eugenic sterilization in its state institutions, a total of approximately 5,000 operations having been performed up to January 1, 1927. Of these, four-fifths were in the state hospital for the insane, one-fifth in the state home for the feeble minded. At the present time no one is allowed to leave the latter institution unsterilized. In the hospitals for the insane, only one new admission in five or six is sterilized.

For the last two years, a thorough study of the workings of this law has been under way, financed and directed by E. S. Gosney, a Pasadena philanthropist, in consultation with an advisory committee made up of recognized authorities in many different lines. Our judgment is that, on the whole, the law is functioning to the satisfaction of those interested, such as the medical profession, the social workers, and the relatives of sterilized patients, as well as of the patients themselves. The grounds for these conclusions are being published elsewhere.[1]

Vasectomy is performed on the male, salpingectomy on the female. There have been four deaths in these 5,000 operations: a man and a woman from effects of ether anesthesia, two women from peritonitis. There has been no fatality to either sex in any hospital since 1920, although more than one-half of all the operations have been performed since then. The success of the sterilization law has led to extensions in two directions:

STERILIZATION IN PRIVATE PRACTICE AND OF VOLUNTARY PATIENTS

First and most important has been the sterilization of women in the private practice of physicians. Few males are sterilized privately. We think it likely that the number of salpingectomies thus performed in the last 19 years is fully as great as the number performed in the state hospitals under the eugenic law, namely, about 2,000. We hope to be able to offer some detailed information on these private sterilizations in a future paper.

The second extension has been the sterilization of voluntary patients in the state hospitals. While the law provides for compulsory operation

1. This material may be obtained by application to E. S. Gosney, 26 N. Marengo Avenue, Pasadena, California.

on the recommendation of the medical superintendent approved by the Director of the Department of Institutions and the Director of the Department of Public Health, it has become the practice to get the written consent of the nearest relatives, thus in effect making the operation a voluntary one. Not one case in ten, perhaps not one case in twenty, is sterilized without such consent, if there are any relatives accessible.

PATIENTS "FOR STERILIZATION ONLY"

The next step has been for the institutions to receive patients who come for sterilization only. In the state hospitals for the insane the patient is received as a volunteer without court commitment. Most of the hospitals have accepted a few such patients, nearly all women, letting them leave as soon as they recover from the effects of the operation. As far as our records show, the largest number received specifically for this purpose by any one hospital up to the time our study was made is sixteen, of whom three were men. Time does not permit a detailed analysis of these cases here.

At the Sonoma State Home for the Feeble Minded, a large number of cases has been received. Here the patients have in almost every instance been committed by juvenile courts at the request of relatives and social workers. The present study is limited to 66 girls whose application blanks stated that they were sent "for sterilization only," with the idea that the girl return to her community as soon as possible after the operation. Other girls, and some boys, were sent for the same purpose. To avoid personal bias in selection, we limited this study to those whose written applications stated unequivocally that they were sent primarily or solely for the operation, not for training or custodial care such as the institution is expected to give to the usual patient.

The question that we set ourselves to answer was in what way these girls, sent for sterilization only, differed from the average run of sterilized patients, both as to characteristics before admission and as to record after admission. The principal facts are shown in Table I, actual numbers being the same as in Table II. The most striking fact is that there is so little difference between the two groups. In age, average intelligence, previous behavior (three-fourths of each group had a record of sexual delinquency), and in family background, the group sent only for sterilization might serve as a sample of the whole.

TABLE I

SALIENT FACTS ABOUT CERTAIN PATIENTS STERILIZED AT SONOMA STATE HOME

MEANS	Females sent for sterilization only	All sterilized females
Age at admission	20.12 ± .61	19.39 ± .19
Intelligence quotient	62.54 ± 1.29	61.69 ± .44
Moral rating[2]	1.92 ± .04	1.96 ± .04
Father's Barr rating[3]	7.02 ± .29	6.62 ± .11
Percentage with positive family history[4]	74.47 ± 3.60	74.69 ± 1.70
Age at operation	21.65 ± .57	21.99 ± .19
Delay prior to operation[5] (years)	1.53	2.60
Percentage with both parents born U. S.	49.09 ± 4.50	49.09 ± 1.90
Percentage with both parents foreign	27.27 ± 4.00	34.85 ± 1.80
Age of mother at patient's birth	27.40 ± .57	27.30 ± .25
Number of living sibs	4.26 ± .18	3.90 ± .06
Number of mother's pregnancies	5.28 ± .21	5.92 ± .14
Percentage married prior to admission	21.21 ± 3.40	13.95 ± 1.10
Number of living children of same	3.07 ± .42	2.87 ± .19
Percentage of unmarried mothers	19.66 ± 3.30	7.33 ± 0.90
Percentage married since operation	18.46 ± 3.20	23.40 ± 1.40

Fourteen of this group were married and had had 53 pregnancies (of which some were illegitimate, however). Of the single, 11 had had one illegitimate child each, one had two, and another four. The remainder were single, but 21 were known to have had sex experience.

SUBSEQUENT HISTORIES

Of the 14 married women, all have left the Home. Two had to be sent to hospitals for mental diseases. Another who is back taking care of her own home may have to be committed in this way soon, as she is distinctly a mental problem. Five more are taking care of their own homes (two of these are high imbeciles, with six living children each, a third a middle imbecile (I. Q. 36) who has borne 11 children, of whom seven are alive); three are on industrial parole, three went back to their homes and later dropped out of sight. With reservation for

2. We divided the patients into four classes, No. 1 being those who were not delinquent and were sent merely for protection or training, the other numbers representing increasing grades of delinquency. This rating is explained in the tnird paper of this series, "Success on Parole after Sterilization," in **Proc. American Assn. for the Study of the Feebleminded**, pp. 86-103, 1927.

3. The socia-economic status of men is graded on a scale devised by F. E. Barr and published by L. M. Terman in **Genetic Studies of Genius. I, Mental and Physical Traits of a Thousand Gifted Children**, pp. 66-72, Stanford University, 1926. The scale ranges from the hobo (0.00) to the inventive genius (20.71), according to the amount of intelligence necessary for success in the occupation. A rating of six or seven corresponds to the semi-skilled trades.

4. That is, with any other case of mental disease or mental defect in the near ancestry.

5. Calculated by subtracting the age at admission from the age at operation. The average female in the first column therefore is seen to spend a little over 18 months in the institution, prior to sterilization.

the three last-mentioned, there has been no failure on parole in this group, and the operation seems to have been a success in the sense expected, that is, it allowed the woman to continue in her own environment without the complication of bearing further children who could not be cared for properly.

Of the 13 single illegitimate mothers, six have married since sterilization, and four of these have settled down and are doing well. One soon became little better than a prostitute, and was sent back to the Home, where she will probably stay indefinitely. The sixth was sent back to her home in Honolulu, where she married a soldier, and thereby got out of reach of the California authorities. Soon, however, she came back to California to get her child, but did not communicate further with her soldier husband, who thereupon divorced her on the ground of desertion. She then married again in San Francisco, but we have been unable to learn further of her, and a verdict in her case is suspended. Of the seven who are still single, five are on industrial parole and doing well. A sixth returned to her own home, but did not prove amenable to discipline there, and at our last report her mother was preparing to send her back to the institution. The seventh was found, in the institution, to be so over-sexed and lacking in inhibitions that she has never been allowed to leave.

Of the remaining girls, seven have married and an eighth, who is now working for a telephone company, is about to marry. Four of the marriages have been successful, two are unknown, the seventh left her husband and was reported to have become promiscuous.

This leaves 31 single girls of whom two are still in the institution, never having been out, and one of whom died shortly after returning home. Three who returned to their own homes are unknown, but in at least two of these cases they went back to good homes and there is every reason to expect a satisfactory report from them. All the rest have been or are on parole, with varying results.

We credited 13 of these as definitely successful, as measured by their behavior. Ten are in their parents' homes, and three are working outside. Two cases we classed as doubtful. One went to her own home. The probation officer's report it, "Home conditions not good. The girl ought to go back, but there is no provision for paying her fare." The other case is that of a 15-year-old girl who was sent out to do housework and was not equal to the responsibility. At our last report she was still out, but was expected to return to the institution. In neither of these cases was the girl primarily to blame, yet we could not call her parole successful.

CASES OF UNSUCCESSFUL PAROLE

There are 10 cases in which we consider parole to have been definitely unsuccessful. Two of them who were working out ran away and have not been heard from. Another ran away from her own home, was finally located in a psychopathic hospital in Utah, and was returned to Sonoma. Three who went home were too low mentally and too unadjustable to live outside of an institution. Another was taken by her mother to Milwaukee, and there began going with men so that she was committed to the Wisconsin Industrial School for Girls. The other three became quite promiscuous at the first opportunity, and had to be taken up and returned for custodial care.

The careers of the 66 girls are summarized in Table II, in comparison with those of the other girls in the group.

To simplify still further the picture presented in this table, and to emphasize an important point, the doubtful may be divided equally between successful and unsuccessful, and the unknown and all others omitted. When the percentages are recalculated on this basis, it is found that 72.55+4.20 per cent of those sent only for sterilization made a success when sent out; while 80.22+2.00 per cent of the remainder were successful. On the face of the returns, those sent for sterilization only did not do so well as those sent in the usual way; but the difference is not great enough to be significant statistically, in view of the probable errors.

TABLE II

STATUS OF GIRLS STERILIZED AT SONOMA STATE HOME

	Sent for Sterilization Only		All Others	
	Number	Per Cent	Number	Per Cent
Never left the institution	3	4.54	107	29.77
Died	1	1.51	3	0.84
Transferred to other institutions	2	3.03	3	0.84
Paroled, successful	36	54.55	141	39.49
Paroled, doubtful	2	3.03	11	3.08
Paroled, failure	13	19.70	30	8.40
Paroled, result unknown	9	13.64	62	17.38
	66	100.00	357	100.00

GIRLS NEEDING INDEFINITE CUSTODY

If a girl is sent for sterilization only, it must be presumed to mean that in the judgment of someone sending her she is qualified to get along successfully in the community if sterilized, and that she does not require prolonged custodial care. The facts do not always bear out such judgment. It is evident that some social workers are too opti-

mistic as to a girl's ability to adjust herself to community life, and are sending for sterilization only girls who should be sent for indefinite custody. Fortunately, the medical superintendent is the sole judge of the proprieties, once a girl has been committed legally, and he can refuse to release her if her record while in the institution does not warrant it. He also can, and usually does, keep her on parole instead of discharging her, so that she can be returned at any time that she fails to make good. Of the 66 girls here considered, only seven have been discharged. Two of these were dropped from the books because transferred to other state hospitals. Four of the others were married, the fifth, who is working as a nurse girl in a private home, is under the supervision of her County Agent.

The state is thus able to, and does, protect itself against overzealous social workers. But the conclusion is inescapable that sterilization is a matter of public concern; that, in general, it must be considered an integral part of a state system of supervision of the incompetent; whence it follows that private sterilizations, performed outside of the state institutions designated under the law, should also be subjected to some sort of state supervision.

THREE GROUPS OF VOLUNTEERS FOR STERILIZATION

The women who come as volunteers for sterilization to the state hospitals for the insane are likewise prompted in most cases by relatives or social workers, and they do not differ socially in a marked way from the group here considered that was sent to the State Home for the Feeble Minded. In each case three groups without much overlapping can be distinguished:

(1) *Women Who Have Borne Many Children.* The first group is made up of defective women who have already borne as many children as they can take care of, usually more, and who are sterilized merely to prevent continued childbearing from breaking up a home and throwing additional burdens on the county charities. Delinquency is not a question in these cases.

A striking illustration is furnished by a woman with seven living children who was committed to one of the state hospitals for mental diseases. When sterilization was suggested, she seemed dismayed, and said she would have to consult her husband. Following his next visit, she reported to her physician that she had talked the matter over with her husband and they had agreed that she ought not to be sterilized at the present time; later perhaps, but not now. "You see," she explained, "we are getting half-orphan aid from the state for each of our seven children. We have figured out that when we have two more children, the amount we receive each month will be enough for us to live on, and

then my husband won't have to work any more. So we wouldn't want for me to be sterilized just yet."

While this case is like the weather in California—"very unusual"—it yet represents only the extreme of a situation that exists somewhat more frequently.

If one accepts the principle of sterilization at all, one would be likely to consider these suitable cases for sterilization; and their subsequent history seems to indicate that the operation did what was expected of it, without any counterbalancing ill effects. On the other hand, it seems unnecessary to send such patients to a state hospital, perhaps 500 miles from their own homes, for sterilization; it might be done, under suitable safeguards, in their own community.

(2) *Girls of Low Mentality Cared For by Parents.* The second group consists of girls of the lowest level of intelligence, who will never be anything except custodial cases, but whose parents are well able to assume the burden of their care, and prefer to keep them at home. To prevent pregnancy in case some man should take advantage of the girl, however, they desire to have her sterilized. A number of striking cases of this sort have been sent to Sonoma, including the only two idiots in this group of 66. It is worth mentioning, in passing, that the mother of the lower of these (I. Q. 16) noted on the application blank that the patient is "fond of men." That the danger to these girls of low intelligence is real will probably be admitted by most informed persons. It is illustrated by the history of a 15-year-old girl, who is not in this group but ought to be. A low imbecile with I. Q. 29, and mental age 4-4. She was, in addition, so unattractive physically (being humpbacked and having an umbilical hernia among other things) that her parents believed she was quite safe in their own home, and used occasionally to leave her there while they went out. On one such occasion she was raped by a delivery-man, and gave birth to a child, whereupon she was sent to Sonoma to be sterilized.

Some have suggested that these individuals of lower levels of intelligence ought all to be institutionalized. Whatever the merits of this proposal, the fact is that there are not enough institutions in the United States at present to receive all of them; and if the parents of such an individual can keep her, the available institutional space can be used for some one who is delinquent as well as intellectually subnormal and whose custody will be more advantageous to the state.

(3) *Sexually Delinquent, Mentally Abnormal.* The third group consists predominantly of young women, unmarried though often illegitimate mothers, sexually delinquent and more or less abnormal mentally. The records indicate that this type of girl is sent for sterilization

because it is felt that she will otherwise produce defective, probably illegitimate, children. By sterilization, the state will be protected from this undesirable addition to its citizenship, as well as from the burdens and depression that would fall on family and community.

While the assumption is well based, the histories show plainly enough that reproduction is by no means the only anti-social contribution such a girl can make; that sterilization will not change her intellectual and emotional make-up; and that the larger interests of society can be protected only if she is placed under careful supervision, if not in institutional custody. Sending such girls for sterilization only, to a state hospital, argues a misconception of the proper function of sterilization in any scheme of social betterment. So long as they are sent to state hospitals, the superintendents of these institutions are able to use their authority to protect the state. But if sterilization outside of the hospitals spreads—as it is in fact doing—and if this same type of girl is sterilized privately—as already occurs occasionally—without any such supervision later, unfavorable results are certain to follow.

There is every reason, then, why voluntary sterilization should be put entirely under state supervision. The operation is too important a thing to be left to the discretion of all sorts of private individuals. If a woman's condition is serious enough to require her sterilization for any reason, it is serious enough to require that this operation be made a matter of record in some appropriate way.

SUMMARY

1. A few volunteer patients are being received, at California state hospitals for mental diseases, for sterilization only.

2. A larger number, mostly females, are committed to the Sonoma State Home for the Feeble Minded, with a view to their sterilization and return to their own community as soon as possible.

3. Analysis of their histories shows that these girls do not differ markedly from other girls sterilized at the institution, either in their history prior to admission, or their record on parole.

4. The subjects studied in this paper seem to fall mostly into three groups: (a) Non-delinquent but mentally abnormal married women who are sent in order that they may not bear any more children; (b) girls of the lowest levels of intelligence, who are being kept at home by their parents, and who are sterilized to guard against pregnancy in case some man should take advantage of them; (c) delinquent and mentally abnormal young women whose characters and records are such as to make it seem probable that they will bear illegitimate children if not sterilized.

5. If the principle of sterilization is accepted at all, it is concluded that the first two groups offer no difficulties. The last-named group, however, requires not only sterilization but careful supervision—sometimes even custodial segregation instead.

6. In view of the growing tendency to extra-institutional sterilization, which includes members of the third group as well as of the first two, it is concluded that all such sterilization should be put under control of the state, in order that all the interests of the public may be protected, and not merely those concerned with the reproduction of the mentally defective or socially inadequate.

THE STERILIZATION OF FEEBLE MINDED IN MICHIGAN

H. E. Randall, M.D., President Michigan State Medical Society.

Every physician is aware that certain diseases are hereditary and inheritable. Among the conditions that are carried down from generation to generation may be mentioned migraine, deaf mutism, color blindness, astigmatism, fragile bones, cases of phalangeal ankylosis (7 generations, Harvey Cushing—14 generations, Drinkwater), food idiosyncrasies, polydactylism, blood groupings, hemophilia, familial hemolytic jaundice or family jaundice, hereditary ataxia, Huntington's chorea (10 generations), skin diseases like psoriasis, ichthyosis, etc. Resistance to disease and longevity themselves are inheritable.

This is not a complete list, but it is used to illustrate the fact that inheritance of defects of physical development are well known, and since the brain is part of the physical make up, congenital mental deficiency may belong to the hereditary group. Please remember, however, that not all mental defectiveness is due to heredity. There is a considerable number of feeble minded who are the result of severe sickness changing brain cells.

No one would think of deliberately bringing into this world a line of blind children or a line of children without arms or legs or with any of the great handicaps of life and support, and this we believe is the same problem as the propagation of a line of feeble minded.

Immigration laws have been passed by Congress to exclude undesirable classes. The right of marriage has been limited and regulated for the protection of the State. Laws have been passed prohibiting marriages between white and black races, and prohibiting the marriage of the feeble minded. But this has often failed. Clarence Darrow seems to have missed the point in his criticism of Albert Wiggam, that the feeble minded tend to mate with the feeble minded, while the Edward's family married among the normal classes. A mating of the feeble minded doubles the probability of inheritable mental deficiency.

THE DEMANDS OF PUBLIC WELFARE

In 1923 the legislature of Michigan passed an act to authorize the sterilization of the mentally defective person. The act was written by Burke Shartel, a professor of law at the University of Michigan. The act was upheld by the Supreme Court of Michigan with a divided court. This year in May the United States Supreme Court upheld a similar sterilization law for Virginia with but one judge dissenting.

The United States Supreme Court decision is good reading for those who believe in sterilization in cases of the hereditary feeble minded. Although no brief was filed by the State of Virginia, the decision upholding the Virginia law settled this particular act and that of states that safeguard the rights of the individual and at the same time guard the safety and welfare of the state. The decision says:

Virginia case, decision May 2, 1927—Buck v. Bell, 47 Supreme Court, 584.

"We have seen more than once that the public welfare may call upon the best citizens for their lives. It would be strange if it could not call upon those who already sap the strength of the state for these lesser sacrifices, often not felt to be such by those concerned, in order to prevent our being swamped with incompetence. It is better for all the world if, instead of waiting to execute degenerate offspring for crime, or to let them starve for their imbecility, society can prevent those who are manifestly unfit from continuing their kind. The principle that sustains compulsory vaccination is broad enough to cover cutting the Fallopion tubes. Jacobson v. Massachusetts, 197 U. S. 11, 49 L. ed. 643, 25 Sup. Ct. rep. 358, 3 Ann. Cas. 765. Three generations of imbeciles are enough.

"But it is said, however it might be if this reasoning were applied generally, it fails when it is confined to the small number who are in the institutions named and is not applied to the multitudes outside. It is the usual last resort of constitutional arguments to point out shortcomings of this sort. But the answer is that the law does all that is needed when it does all that it can, indicates a policy, applies it to all within the lines, and seeks to bring within the lines all similarly situated as far and as fast as its means allow. Of course as far as the operations enable those who otherwise must be kept confined to be returned to the world, and thus open the asylum to others, the equality aimed at will be more nearly reached.

"Judgment affirmed. Mr. Justice Butler dissents."

The fear of the dissenting judge of the Michigan Supreme Court has not been fulfilled—that the sterilization movement would extend to cover any inmate in our state institutions and would require 4,000 to be sterilized the year the decision was given.

As a matter of record, but 111 patients have been sterilized at Lapeer since the act was passed four years ago. Sterilization is not offered as a means of entirely eradicating the 73,000 or more feeble minded in Michigan. Sterilization is not a panacea. But sterilization is a valuable procedure where your patient has collateral families bearing feeble minded children.

STERILIZATION IMPROVES MORAL CONDUCT

One of the arguments used against sterilization was that with the fear of pregnancy removed it would promote loose moral conduct and spread venereal diseases. The reports of patients operated do not bear out this assumption. In fact the reports show, of Michigan and California, that it leads to an improved moral conduct. One-fourth of the states now have a sterilization act and the courts have declared it constitutional. The problem is not with the idiot, for he is the last of his line. The operation removes no organs, and while we have seen no improvement as Steinach reports in rejuvenating old men, our own impression is that none has been made worse, that all have recovered promptly and that the operation has lead to a cleaner moral life of the paroled.

The report of Paul Popenoe says that, in California, of 605 patients or two-thirds of those sterilized at Sonoma, one girl in twelve became sexually delinquent after sterilization, while nine in the twelve had been sexually delinquent before sterilization. Of the boys, among those classed as failures on parole, there was a sexual element in the failure in only one case (an exhibitionist).

California has carried out sterilization more extensively than any other state. Of the 2,000 females sterilized, five or six only considered infertility an asset in promiscuity, and no single instance was found in the 3,000 men sterilized.

Dr. Wm. J. Kay, Superintendent of Michigan Home and Training School, has kindly furnished me the following report:

"We have studied the folders of 111 sterilized cases. Of those, 27 are in the institution. Most of these have never had an opportunity outside; some are school girls; some recent sterilizations; a few have syphilis; one psychopathic, and a few unstable patients. The balance of the 27 have been out and been returned because home conditions were not satisfactory or they were unable to make a living.

"This leaves 84 who have lived outside of the institution after sterilization. Of this number there are 14 whose histories since leaving the institution are unknown; leaving 70 whose histories were known before and after sterilization. Of this 70 over one-half were promiscuous. Of the same 70, after being sterilized and tried outside of institution, only 11 gave histories of sex delinquency. The other 59 have made satisfactory adjustments with no history of sex delinquency."

STERILIZATION APPROVED BY INTELLIGENT PEOPLE OF EVERY STATE

JUDGE CLARK E. HIGBEE, Probate Court, Grand Rapids, Michigan.

It might be of interest to you to know that in Kent County we have sterilized something over 115 since the law went into effect. I understood Dr. Randall to say 1893. The law was passed in 1923. There had been a sterilization law on the books of Michigan, but it was declared unconstitutional.

The present law differs very radically from the law in California. In Michigan only the feeble minded are sterilized. In California the law includes not only the feeble minded but the insane and the epileptic. Personally I feel that the California law goes altogether too far in including these two classes. The feeble minded have nothing to contribute and they have nothing to transmit, but the insane very often have a great deal to contribute and a great deal to transmit. To give a striking example, Goethe's mother was a manic depressive. If she had been sterilized Germany would have lost her famous representative of literature. If we were to take the epileptics, it would be interesting to note how much they have contributed to the world's progress.

The California law differs from that of Michigan in another important respect. In California the law is purely administrative, that is to say, the case of John Doe comes up before an administrative board with no right to a jury trial. It is not tied up to the judicial system of California as the Michigan law is. In Michigan the petition is first filed in the Probate Court. The subject of the petition is entitled to a jury trial. He is entitled to an appeal to the Circuit Court and further to the Supreme Court.

A great many people say, "We cannot have a sterilization law in our state because we would get no popular approval of such a law and we cannot enforce it." Kent County has a population of a little better than 200,000. One-half of our population have Dutch blood, about one-sixth are Slavic, Polish and Lithuanian and yet we are sterilizing at a greater rate in Kent County in the last two years than anywhere else in the United States, and we find no popular clamor against the sterilization law. I believe that all that is necessary is to educate the group leaders in each county.

The ignorance about sterilization is surprising. A Roman Catholic Bishop of western Michigan told me a year and a half ago, after I

had spoken to an audience, that it was the first he had known of what sterilization meant. He saw no reason, after the matter had been explained to him, why he should not approve of sterilization. The intelligent people of every state will approve of sterilization if they understand the biological laws and if they understand exactly what it means.

THE DELINQUENCY OF PARENTS

RUTH THOMPSON, Judge of Probate, Muskegon, Michigan.

During the past year the public and parochial schools in my county have had a total enrollment of 20,350. During the same year 160 delinquent children and 97 dependent and neglected children appeared in the Juvenile Division of the Probate Court. You will agree that the number is very small. My county is peculiarly situated, up the lake from Chicago and directly across the lake from Milwaukee. Many foreigners are attracted to the smaller city. Then, too, we are the first industrial city south of the straits of Mackinac. From this source we attract countless poor, illiterate, shiftless families who have been driven out of the Jack-pine country by sheer starvation. All of these people naturally contribute to the work of the Juvenile Court.

As I sit in judgment, the thought has often occurred to me that we need not a Juvenile Court so much as we need a Court for Delinquent Parents—parents who are neglecting their children and in every way contributing to their delinquency. Of course there are exceptions to these cases. In my work I take the time and have the inclination to become intimately acquainted with the children, their families and their entire background, and I have seen many instances where a court record could have been avoided if the parents had shown a proper interest in the child.

THE PARENTS' RESPONSIBILITY FOR TRUANCY

Let us take the child who is an habitual truant from school. Are his parents genuinely interested in giving him an education? They claim to be, and one cannot fail to observe the injured air they assume when the court tells the child that he is not giving his parents a square deal; that they are making sacrifices every day in order to give him an education. As a matter of fact, if they are interested in giving him an education, he comes into court just once; otherwise, he makes his appearance in court rather regularly until other measures are resorted to.

THE CASE OF TONY

Then we have the child who is an habitual thief. Sometimes, to be sure, we are baffled to know the reason for his conduct, but in most cases it is quite apparent. Sometimes the father has a court record, sometimes the mother has had a past. Having served as Chief Clerk in my court for more than nineteen years, I have learned always to

obtain the maiden name of the mother. Very often it is the key to the whole situation for I find the records or my memories serve me well.

Let us take the case of Tony: He would take anything from a needle to an automobile. When I took office he had been in the Detention Home for nearly a year. He was an habitual thief, but he could not be committed to an institution because of his age. His twelfth birthday was supposed to be January fourth. His parents were summoned into court on the fifth. When asked his age, Tony promptly replied "eleven." Through the Church records this was found to be correct. It meant that Tony would be with us another year. But instead of being returned to the Detention Home, where for nearly a year he had been fed, clothed, housed and sent to school with no expense to his family, he was sent home to the father and mother. The arrangement was that if for any reason he was again picked up by the officers, he would be detained in the Detention Home, not at the expense of the County but at the expense of the parents.

The threat was apparently not serious, in their estimation, for in less than a week Tony was brought in for snatching a purse containing twenty dollars. He was committed to the Detention Home and his father was notified to appear at the end of the week and pay four dollars for his board and care. Of course he insisted that he could not pay it. There were nine other children in the family. I maintained that I would put the matter before his employer and that we would have no difficulty in getting it, and that as a result he would probably lose his job.

Tony's board was paid for three weeks. At the end of that time he was allowed to return home. We had no further trouble. It was the purse strings, not the heart strings, that needed to be touched.

HELEN

And then let us take the case of Helen. She was brought in for stealing repeatedly in the school room. In getting to the bottom of the case, the mother admitted she was keeping house for a man who never paid her any wages. All the money she ever had was what she took out of his pockets when he came home under the influence of liquor. Helen was only fourteen, but she admitted using cigarets. By accident the court noticed the discolored fingers of the mother, and she admitted having used tobacco since before Helen was born.

ETHEL

Then we have the delinquent girl who is a sex offender. My heart aches for her because her early training has been sadly neglected, because her parents are not setting her the right example or because she

has lacked a proper home environment. Ethel could certainly not be classed as a bad girl, when at the tender age of twelve years she was to become a mother. She and her half-witted step-brother occupied adjoining rooms alone on the second floor of the home. The mother was too busy paying attention to a newly-acquired "husband" to fear for the child. Evelyn had a mother who took her place as a respectable woman in the community for several years. She kept house for a widower, and while they insisted the child had never "seen" anything wrong or at all improper, still the very atmosphere in the home told that this woman was the man's common law wife. I was not terribly shocked that the girl was a sex offender. She was very promptly taken out of the home and will not be returned until a marriage ceremony is performed.

CORA

And then there was Cora—a tall, slender, laughing, good-looking girl. She admitted that she had had improper relations with any number of boys in the neighborhood. She broke the terms of her probation repeatedly, and not until she had been committed to an institution did she disclose the heartache beneath her armour and tell her story. And then she challenged the court in this manner: She was one of sixteen children. All her life a baby had come to the home every year. All her life the family had lived in a three-room house. All her life she had worn cast-off clothing. All her life she had been refused the opportunity to have friends come to her home.

What could I say in reply? From the bottom of my heart I pitied her, and it is only one more argument as far as I am concerned against large families. I can see no merit in the majority of them, in the present day and age.

THE EFFECT OF BROKEN HOMES

Let us consider the dependent and neglected children. Whence do they come? Not from families where the father has been taken by death. They are taken care of by our wonderful Mothers' Pension Fund. Not from the families where the mother has been taken by death. There are always good institutions as well as good individuals who are looking for opportunities to give a helping hand. The dependent and neglected children are from the broken homes. The parents have separated and sometimes re-married, in either event with no idea of taking on the obligation of caring for the children. They come from homes where the mother has lost interest in home duties and family ties, and has sought diversion in the down-town restaurant.

I have in mind a family of nine children. The mother decided she could no longer put up with the responsibility of caring for the home.

She found work washing dishes in one of our restaurants—I would like to say one of our dives. The father was an old man for whom the children had no respect. This is what has since happened to the family: One boy is serving time in the Ionia Reformatory, one is a patient at the Michigan Home and Training School, one is at the Boys' Vocational School, three girls are in the House of Providence and another boy is in our own Detention Home.

THE PROBLEM OF DEFICIENCY

In dealing with our children, we must constantly keep before us their mental status. There is nothing I would like better than to have the services of a full time psychiatrist in connection with my work. How much easier it would be to solve the problem. And how many of our delinquent, dependent and neglected children are woefully deficient. I have in mind a family of nine who were reported in most deplorable circumstances. They were summoned into court. The father was very noticeably under the influence of liquor, the mother was a perfect blank. The children were all given a mental test. Of the seven, six were found to have an intelligence quotient below 64. All have been committed to our Michigan Home and Training School at Lapeer. The mother has been adjudged feeble minded and the machinery is in motion to have her sterilized. She has given birth to ten children, more than her share, to be sure. I am glad that it is within my province to stop procreation in that family.

CASES OF INHERITED DISEASE

And now let me take just a moment of your time to call your attention to our afflicted and deformed children. They, too, come under my jurisdiction, and I know how true it is that the sins of the fathers are visited upon the children. I have been making a campaign to give every indigent afflicted or deformed child in my county an opportunity for treatment in our splendid University Hospital. Aside from many cases of infantile paralysis and accidents, the trouble is inherited. Only last week I returned a lovely fair-haired child of ten for treatment. She was totally blind. Very casually I said to her, "Helen, what does the doctor say about your eyes?" She said, "Oh, he doesn't say anything to me but I heard him tell another doctor there wasn't much hope for me—I was a 'Four Plus' (syphilitic) case." That child doesn't realize now, but the time will come when she will, and then what a revolt!

Day after day my heart goes out to the unfortunate child. My earnest prayer is that I may be more tolerant, more charitable, and that I may not be unmindful of the wonderful blessings that God has given to me.

THE PHYSICAL BETTERMENT OF FUTURE CITIZENS THROUGH IMMIGRATION

Honorable Harry E. Hull, Commissioner General of Immigration,
United States Department of Labor

Immigration is the oldest, most important and least understood of any of the great problems that have confronted the human race. Nations and civilization are always created by immigration. They are made strong or weak by the infiltration of alien stock, and finally fall by a surge of immigrants they cannot assimilate. Immigration is the fundamental cause of all history, for upon immigration rests the citizenship of every country. The acid test of any civilization is the men and women it produces and the manner of their living. The citizenry of any nation is the first and last line of national defense.

Good citizenship is the greatest need of any country. A high order of citizenship is vital to any nation. The fact is patent to any one who stops to think. No one will dispute the proposition that a country can be no stronger and no richer than its citizenship. In whatever riches it has, a country is no more secure than the quality of its citizenship allows. A country can rise to no greater heights than that its citizens, as individuals, are able to attain.

Not only that, but a country in which the quality of citizenship is sinking is sure to decline. The greatest nation in the world must suffer that fate if it permits decline in the quality of its people. History is full of the lamentable proofs of this. Empires that once ruled the world have fallen in utter decay, as a result of prolonged decay in the vigor of their people. For many years America ignored these truths, and even these warnings from history. Now at last we have waked to the supreme importance of preserving the fibre of our citizens, and from now on eternal vigilance shall be our watchword.

PART I—THE HISTORY OF UNITED STATES IMMIGRATION LAWS

American immigration problems have existed ever since American civilization began its rapid strides forward. During the thirty years prior to 1820, the first three decades of our history as a nation, it has been estimated that about a quarter of a million immigrants reached our shores. In 1820, the year in which we first began to keep an accurate account of arrivals, about 8,000 were recorded. For the next 17 years the number steadily climbed, until in the year 1837 we added about 79,000 to our population by immigrant arrivals. Five years later, that is in 1842, immigration had passed the 100,000 mark, and still the

number of yearly arrivals mounted. For the twenty years prior to the Civil War, the average annual immigration was well over 200,000. After the close of that struggle, immigration resumed its upward climb, until in 1882 nearly 800,000 immigrants came to join us. There was then a temporary decline, the half million mark being exceeded only a few times from 1882 to the beginning of the present century. Nevertheless, the annual average for that 18-year period was more than 400,000.

With the twentieth century immigration took on an added impetus. During the fourteen years prior to the World War, immigrants came in at the rate of more than 900,000 per annum. Indeed, during six separate years of that period, the annual influx was well over a million.

THE GROWING SENTIMENT IN FAVOR OF IMMIGRATION CONTROL

Having these imposing figures before us, and having the aftermath of the world conflict to consider, our people might well pause, as they did, and look to decided restrictive measures to curb this growing flood of foreign peoples. It is perhaps strange, but none the less true, that we found, during the present century, that the quality of immigration did not keep pace with the increase in quantity. We found also that, however excellent these newcomers might be in their own native environment, they were coming too fast for us to assimilate, they were retaining their own national traditions and customs. They made us by their very numbers fear lest our own cherished institutions be submerged. There was very general sentiment among our people that the tide of immigration should be controlled.

It is small wonder that thinking Americans began to take an inventory of the stock on hand and to appraise the human elements that were thrusting themselves upon us from abroad. In response to this sentiment, the Congress perceived that steps must be taken to conserve and to protect this country's social and industrial progress from the menace of these alien peoples, who through no fault of their own were unprepared to make the proper contribution to our country's national well-being.

It is not to be supposed that, during the past hundred years of immigration that I have just sketched for you, no legislative efforts were made to regulate the growing stream of immigrant arrivals, but it must be admitted that our countrymen were slow to realize the dangers to our racial heritage and likewise slow to take effective precautions.

THE BEGINNING OF FEDERAL LEGISLATION

Early in our history our public men from time to time were concerned over the immigration question. From Colonial times to about 1833, immigration was accepted much as a matter of course. The Act of March 2, 1819, may be said to have marked the beginning of federal legislation on the subject of immigration. It was a measure designed to regulate the carriage of steerage passengers at sea, and it provided that manifests or lists of passengers carried must be delivered to the customs authorities at the port of arrival. Hence, from the time when that act took effect, we have been able to keep accurate immigration statistics. In those early decades of the 19th century, various states were trying on their own account to legislate in such a manner as to afford control of immigration, but owing to the doubtful status of such state laws under the federal constitution and probably also due to the vexatious nature of the problem itself, it cannot be said that efforts by the states were in any degree successful or permanent.

THE BETTERMENT OF IMMIGRANT CONDITIONS ABOARD SHIP

It is significant that the early efforts by the federal government to legislate on immigration had as their chief concern the betterment of conditions aboard ship for the immigrant. They were intended to limit somewhat the number of passengers carried, and provide better sanitary conditions and ventilation. There seems to have been no thought of extending protection to this country or any recognition of the danger to this country from uncontrolled immigration.

The next federal measure was passed in 1847. This superseded the Act of 1819. It was drawn with similar purposes of adding to the comfort and safety of steerage passengers and of preventing overcrowding aboard the immigrant ships. After a little more than a year's interval, in 1848, Congress again tackled the question by passing an act superseding the previous measure, for the first time requiring that all arriving or departing passenger ships have on board prescribed amounts and kinds of food.

The next passenger act was that of 1855, and this went somewhat further in providing for increased air space and sanitary arrangements. It was intended sharply to limit the number of passengers carried, although it really failed in this, its main object, through a defect in the wording of the text.

In 1860 there was an amendment to the 1855 law, to better protect female passengers. The 1855 act, thus amended, continued in force until 1882, when the period of national control of immigration really began.

THE ENTRANCE OF PARDONED CRIMINALS

I may say, in passing, that in the year 1864 Congress made its first and only attempt to promote immigration. The measure continued in force for four years and was then finally adjudged a failure. And I might also observe that in 1866 a joint resolution was passed by Congress against the practice of certain foreign countries in pardoning their criminals and sending them to this country. The resolution stamped such practices as unfriendly acts, and is important as indicating the growing feeling in this country against the entry of undesirable aliens.

OPPOSITION TO ENTRY OF COOLIES FOR LABOR

About this time, also, there began to be a pronounced opposition to the introduction of aliens under contract to perform labor. In the year 1862 the procuring of coolies from any oriental country, to be held for service or labor, was forbidden to ships flying the American flag, and although this measure has been frequently referred to as the first attempt of Congress actually to regulate immigration, the question of importation into the United States was not really considered.

THE FIRST GENERAL IMMIGRATION LAW

I mentioned above that the year 1882 saw the real beginning of federal control of immigration, and such is the fact, but leading up to this was a most notable decision of the United States Supreme Court, in the year 1876, the practical effect of which was to leave no alternative other than national regulation. The Supreme Court expressed itself as of the opinion that the whole subject of immigration had been "confided to Congress by the Constitution." Immediately thereafter general immigration bills were introduced in the Senate and in the House. Nothing was enacted into law, however, until 1882, when, during President Arthur's administration, the first general immigration law was approved.

The law provided for a head tax of fifty cents on each immigrant to defray the expenses of regulating immigration, and the Secretary of the Treasury was delegated with administration of the Act. The law also provided that aliens convicted of crime, lunatics, idiots, and persons likely to become public charges should be excluded. That same year the measure known as the "Chinese Exclusion Act" was passed, providing that all immigration of Chinese laborers should be suspended for a period of ten years.

Thus we see the first substantial advance in the way of federal immigration legislation. These measures had "teeth" in them. They were intended to keep out undesirables, and recognized the necessity

for so doing. Though amplified greatly, and extended from time to time, the policy thus set forth has never been departed from, though forty-five years have since elapsed.

A POLICY OF SELECTION

In 1885 Congress followed up these efforts with the first law forbidding the importation of contract labor, subsequently amended in 1887 and again in 1888. During this period numerous bills in amendment of the laws of 1882 were introduced in Congress, but no action was taken upon them. The subject of immigration continued to be a matter of interest, however. A special investigating body, known as the "Ford Committee," reported to Congress and advocated the idea of selection. It was emphasized that "the time had come to draw the line and to select the good from the bad, because the country could not properly assimilate them." Another recommendation of the Committee, which is of especial interest today, was that all aliens should be required to bring a consular certificate of emigration, showing that they were not among the classes excluded by the United States law.

In 1889 a standing Committee on Immigration in the Senate and a Select Committee on Immigration and Naturalization in the House were established. An investigation by the joint committee showed that there were many defects in the law of 1882. Finally came the Act of 1891, which added several excluded classes, created the office of Superintendent of Immigration, and for the first time vested in United States officials the actual inspection duties, which up to that time, under the 1882 act, had been delegated to the states. Thus we see it was not until the year 1891 that the federal control of immigration was firmly and definitely established.

Other important provisions of the 1891 law were the requirements that medical inspection be conducted by physicians of the United States Marine Hospital Service. For the first time provision was made for the inspection of immigrants along the international boundaries of Canada and Mexico.

In the year 1894, the head tax was raised from 50 cents to $1.00.

For the next ten years there was no immigration legislation, although the subject was constantly agitated in Congress.

In 1903, there was a further increase of the head tax to $2.00. Also in the same year, the Department of Commerce and Labor was created, and the Commissioner General of Immigration was placed under the jurisdiction and supervision of that Department.

Prophetic of present day quota restrictions, a bill was introduced in the Fifty-eighth Congress (1903) that proposed to limit to 80,000 the

number of aliens who might enter from any one country annually, but no action was taken upon it.

The immigration law of 1907 was a measure that set the standards of admissibility pretty much as they are today. It added numerous excluded classes, notably mentally and physically defective persons and females coming for an immoral purpose. The head tax was increased to $4.00. There was much discussion at that time regarding a literacy test, but that provision did not become law until ten years later, when the 1917 Act was passed, practically as it now stands. Since 1917 the head tax has been $8.00.

At that point Congress seemed to come to the conclusion that legislation had gone about as far as it could in fixing the standards under which aliens must qualify in order to enter this country. There are, in fact, nearly forty classifications now written into the law under which aliens may be refused admission.

THE QUOTA ACT

The way was now paved for the policy of numerical restriction following up the previous policy of selection, and thus we see that the first so-called Quota Act, which limited the number of aliens that might be admitted during any one year, became effective June 3, 1921. This Act provided that the number of aliens of any nationality who might be admitted under the immigration laws to the United States in any fiscal year should be limited to 3 per cent of the number of foreign born persons of such nationality resident in the United States as determined by the United States Census of 1910. Under that Act 356,995 quota aliens were admissible yearly, although this number does not take into account the exemptions applying to aliens who are natives of countries of the Western Hemisphere and others who had resided therein for a period of one year under the 1921 Act and five years under the 1922 Act, the latter Act being an amendment to the 1921 Act although it did not change the quotas as fixed by the former Act.

The demand for further restriction became so insistent throughout the country that in 1924 Congress passed the present Quota Act, which provides that the annual quota of any nationality shall be 2 per cent of the foreign born individuals of such nationality resident in continental United States as determined by the census of 1890. Under this Act 164,667 quota aliens are admissible yearly.

It is true that the exemption from quotas still applies to aliens of the Western Hemisphere, but this exemption does not extend to other aliens who have resided or become citizens in those countries, as aliens for quota purposes are chargeable to the countries of their nativity.

Thus we have the general immigration law of 1917, which is selective in its nature, and the immigration Act of 1924, which drastically restricts the number of such selected aliens that may come.

PART II—THE ADMINISTRATION OF THE IMMIGRATION LAWS

Since effective administration must follow closely upon law, if desired results are to be obtained, it has been the aim of the Honorable Secretary of Labor, in whom administration of the immigration laws has been vested since the formation of the Department of Labor in 1913, to promote every means to secure vigorous enforcement. Under the present Secretary, notable advances have been made. I shall proceed to discuss briefly two of the most significant forward steps that have been taken toward making the immigration laws effective, namely, the formation of the Border Patrol, and the detail of immigration technical advisors and United States Public Health surgeons abroad to assist American consuls in passing upon alien applicants for immigration visas.

THE BORDER PATROL

It was quickly demonstrated, as the immigration tests became more and more rigid, and especially as the quota restrictions began to be felt abroad, that the machinery devoted solely to the inspection of aliens was insufficient to cope with the immigration situation. Aliens began to avoid inspection by adopting other than the usual means of transportation, and particularly along the land borders were they seeking and finding irregular means of entry. Alien smuggling began to flourish, indeed it became an established business almost overnight. The situation was quickly met, however, by a resolution in Congress, promptly adopted, that made an appropriation for the establishment of a Land Border Patrol in May, 1924, almost coincident with the passage of the present quota law. Again in 1925 appropriation was made for a Coast and Land Border Patrol, and this necessary arm of the Immigration Service has been continued from year to year and increased in personnel and equipment as the limits of appropriations permitted.

The object of the Border Patrol is not only to break up alien smuggling and surreptitious entries of every description but also to force all aliens seeking admission to go through the regular inspection channels.

I wish to say that the Border Patrol has time and again paid for itself in its contribution to a proper enforcement of the immigration laws. Obviously, the unfit and inadmissible aliens who could not hope to be admitted through the regular inspection would have invaded our country in almost unlimited numbers. Thus, the Patrol has given the Immigration Service, of which it is an important arm, a degree of

assistance that can only be termed invaluable. Whatever respects there are in which present enforcement can be bettered, I have no doubt that conditions would have been incalculably worse had we not had the Border Patrol to assist the regular inspection officers in keeping out undesirable aliens.

SELECTIONS AT THE SOURCE

What I regard as the second great contribution to effective enforcement of the immigration laws in recent years is the detail of immigration officers and of Public Health surgeons abroad in an advisory capacity to American consuls. I could devote much time to favorable comment upon the results of this system to date. Our racial condition has experienced the greatest of benefits by this selective method, and will continue to do so. Aliens themselves have been saved much hardship by being notified of any disabilities before attempting to come to this country.

Briefly, the system works out this way: Aliens who seek to come to this country must first secure certain documents from the American consuls. These documents are necessary to permit the aliens to embark, since steamship companies are under a heavy penalty for bringing alien passengers not in possession of the documents required by law. The American consul is empowered by law to refuse to issue the documents to any alien applicant whom he regards as inadmissible under the immigration laws. Naturally, in arriving at this determination, the advice of the immigration technical advisor, and the certificate of the United States Public Health Officer as to the physical and mental health, are of the greatest value as fixing probable status under the immigration laws. This cooperation between representatives of our three government Departments—namely, the State Department, the Treasury Department, and the Department of Labor—has worked out most happily toward the preservation of the standards of our own people.

Public Health surgeons and immigration officers have been assigned to American consulates in Great Britain and the Irish Free State, to Germany, Norway, Sweden, Denmark, Belgium, Poland, the Netherlands, Czecho-Slovakia, and to Italy. Thus all countries having any considerable number of immigrants to the United States now have the technical advisor service.

NEEDED EXTENSION OF TECHNICAL ADVISOR SYSTEM

I recommend, however, in order that we may have the best possible enforcement of the immigration laws with the minimum of hardship to the prospective applicant, and in order that we may, consequent upon good immigration regulation, best contribute to our Racial Better-

ment now and in the future—I strongly recommend that the system be extended eventually to all foreign countries from which immigrants come to us.

If such an extension of the system is impracticable as regards every country, I believe that at least every port of embarkation from which aliens proceed to this country should and could be provided with the necessary officials of this government. I may say that the system has grown in favor with foreign countries, as they have realized the benefits conferred upon their peoples, particularly through saving the prospective immigrant from useless hardship such as formerly resulted when aliens came forward to our ports without any official advice upon their cases.

Since the technical advisor system has been in existence, aliens thus passed upon have been rejected in comparatively few cases after arrival and final examination at ports in this country. I look forward to the time when no immigrant shall be allowed to leave Europe or countries abroad, destined to the United States, without having been favorably passed upon by the United States medical examiner and the immigration technical advisor. I believe that this requirement would be a great safeguard to our economic and social development, which is after all the great end and aim of immigration regulation.

Of course, to further extend or intensify our present inspection methods, additional personnel must be provided and some further administrative expense must be incurred. I do not believe that the increased expenditure necessary to accomplish desirable results would be in such an amount as to stand in the way of the vital end to be attained, namely the further protection and preservation of our racial heritage. The Bureau of Immigration is doing a wonderful work, and doing it well as far as it can with its present personnel.

PART III—PHYSICAL AND MORAL BETTERMENT OF FUTURE CITIZENS

All Americans should be in favor of admitting to this country only those aliens of the higher type who will add to, and not detract from, the moral and physical fibre of the nation.

In his annual message of 1901, President Roosevelt stated: "Our present immigration laws are unsatisfactory. There should be a comprehensive law enacted with the object of working a three-fold improvement over our present system. First, we should aim to exclude absolutely not only all persons who are known believers in anarchistic principles or members of anarchistic societies, but also all persons who are of a low moral tendency or of unsavory reputation. This means that we should require a more thorough system of inspection abroad and a more rigid system of examination at our immigration ports." The

President summed up his recommendations with regard to immigration by saying: "The second object of a proper immigration law ought to be to secure, by a careful educational test, some intelligent capacity to appreciate American institutions and to act sanely as American citizens."

It has become more and more apparent to me that the safety of American nationalism or civilization can be served and improved only by strict attention to the annual contribution of immigrants who yearly seek admission from practically every country in the world.

If the World War did nothing more for us, it brought clearly to America's attention the fact that, notwithstanding our seeming attention to the regulation of immigration, we had been lax and careless with regard to many foreign groups that had seeped into our civilization. In many instances we found that we had admitted anarchists who at once became a menace to the national safety. Within our very midst we found hostile groups whose allegiance to their native countries gave them a hatred, in the time of war at least, for the very America whose advantages they had eagerly sought. A cursory examination of our health and moral institutions showed that we were paying the price of negligence, in the matter of health advantages, and other items of upkeep that might have been avoided by careful methods at ports of emigration. The economic phases had also entered into the situation and we found our native industrial classes competing with masses from abroad whose living standards were inferior to our own, and who, therefore, could work for unscrupulous employers at a low wage.

GOVERNING IDEAS IN CONSIDERING IMMIGRATION PROBLEMS

Along this line, and as regards the considerations that should govern us in encouraging the physical and moral betterment of the stock from which we expect to draw our future citizens, I should like you to go over with me certain recommendations of the Immigration Commission that were published in 1911. They believed that the following ideas should govern in any consideration of the immigration problem:

1. Care should be taken that immigration be such, both in quantity and quality, as not to make too difficult the process of assimilation.
2. Further general legislation concerning the admission of aliens should be based primarily upon economic or business considerations, touching the prosperity and economic well-being of our people.
3. The measure of the national health development of a country is not the extent of its investment in capital, its output or products, or its exports and imports, unless there is a corresponding economic opportunity afforded to the citizen who is depending upon employment for his moral, mental, and physical development.

4. The development of business may be brought about by means that lower the standard of living of the wage earners. A slow expansion of industry that would permit the adaptation and assimilation of the newcoming labor supply is preferable to a very rapid industrial expansion that would result in immigration of laborers of low standards and efficiency who imperil the American standard of wages and conditions of employment.

The Commission agreed that effective effort should be made to insure the entrance into America of a higher type of immigrant from every possible viewpoint.

AMERICAN INSTITUTIONS MUST BE KEPT AMERICAN

I think we must all agree in the conclusion that new arrivals must be limited to our capacity to absorb them; in other words, that American institutions must be kept American. It is thus necessary to maintain our policy of restricted immigration, keeping our methods of a selective nature, with intensified inspection at the source, and quota restrictions based upon a prior census.

Our country has striven through the past centuries to produce a civilization that would stand every test. The hardy American pioneers have been followed, in turn, by leaders in the modern spheres of American life. We have long since taken the commercial lead of the world. Through the principles of democracy we have established a government that is nearly ideal. Our life scientists tell us that the time is soon to come when, by habits and environment of improved degrees, our life span will extend beyond the prophetic three score and ten. These goals are absolutely dependent, however, upon the type of citizenship that we produce in the years to come. We must never measure our civilization by material advance. Efficient business or highly developed inanimate material do not constitute civilization except as the masses of men are benefited thereby. Highly developed civilization of one class of people at the expense of another class has failed and always will fail.

The greatest problem, then, in connection with immigration, is how to preserve our own trend, to advance physically and mentally, and at the same time to absorb the ever-coming mass of aliens who are ceaselessly seeking a share in our citizenship, our civilization, and all the civic ideals we have built up through centuries of stress and courage.

In his Fifteenth Annual Report to Congress, Secretary of Labor Davis said: "We are entitled, it seems to me, in the United States, definitely to select the types as well as the number of aliens to whom we are to give the right of residence and eventually of citizenship."

Factors over which we had no control have influenced the physical characteristics of those who enter America. It is the same old story of

social adjustment, fashioned by environment and opportunity. Even climatic changes are not endured with equal fortitude by migrant classes. This has been true ever since the world began. The fish of the sea, the birds of the air, and the *ferae naturae*—animals wild by nature—have always migrated. And in the struggle for existence that ensued it was a question of the survival of the fittest. In human adjustment, much of the same doctrine is applicable; but to our own adjustment and the adjustment of those who come to us from afar to partake of our common standards of civilization, there is need for more than the animal instinct. There is need for a culture fashioned by the creed of Christian civilization; there is need to make the body, indeed, a fit temple for the soul.

RESULTS OF FAULTY STANDARDS OF IMMIGRATION

Faulty standards in immigration in years past have left their marks upon us. We have borne heavy burdens from the sickness of aliens. It has taxed our financial prowess as well as our social structure. Even in a cursory way we have found out that the proportion of illness of long duration is somewhat larger among the foreign born than among the native born of America.

Striking measures have been disclosed in the wide variety of nationalities cared for, and the large proportion of foreign born among the patients of many typical institutions. One of the motives that leads persons to public dispensaries for medical care is purely economic. They decide to go because they haven't the money to pay for a private physician. This is another stimulant to taxation for public utilities that is common among the foreign born and a drain upon our public resources.

Many a tenement house in large urban centers reveals conditions among the immigrant classes that almost baffle description. Huddled together in limited space, in filth and insanitation, without regard to decency and health, they present a picture of squalor that is a disgrace to any civilization and a menace to the health of the whole community. The census figures show an abnormal proportion of blindness among the foreign born. Insanity has run high among them. Chronic diseases have reached a high ratio in proportion to our native born, and other startling disclosures show conditions that might possibly have been cured among the immigrant classes before they embarked for America, but that now are constantly a burden to our own citizenship safety.

These are the ills against which we must use precautions. It is merely a humane process that it is our duty to initiate, in justice to all.

METHODS OF IMPROVEMENT

Let us, then, without delay, take steps to improve the citizenry of both the foreign born and the native races—both at home and among those who are to come to us from abroad—by inaugurating scientifically conducted inspections and examinations at foreign ports of embarkation Let us establish a corps of physicians and technical advisors in health and in ethical culture, who will use the ounce of prevention over there, and thus reduce the pound of cure that we are now using over here, who will examine every prospective immigrant physically and mentally before he leaves his native country. Be sure that all who are in the future to become American citizens are endowed physically and mentally to make good American citizens. In order to accomplish this, the foreign inspection by technical advisors and doctors of the Public Health Service must be increased.

Place all countries on a quota basis, thereby extending the numerical limitation as to the number of immigrants that can come from any country. This would reduce the number of immigrants coming into this country each year from 300,000 to less than 200,000, which number is approximately the number that was in the mind of Congress when it passed the 1924 Act. In my opinion it is all that we can safely assimilate under the present conditions in this country. We must remember that there are approximately 7,000,000 unnaturalized aliens in the United States at the present time.

Furthermore, if we are to better our future civilization through immigration, we shall need to enforce the immigration laws that exist at this time with justice to all, especially extending mercy to those who by our careless methods are caught in distressing, heart-breaking, family-destroying situations. The present immigration force is not large enough properly to do this.

Thus all will be benefited. The rigors of adjustment to American standards will be reduced. On the other hand, fit immigrant subjects, ready to meet the tests of American civilization and of American health, by which tests those virtues may be stimulated and conserved, will come here where they may be assimilated pleasantly and at slight inconvenience and cost to themselves and us, into the mesh and fibre of all that is idealistic advancement in America, physically, socially, civically, and ethically.

It should be a matter of duty as well as of pride for every American to strive to maintain the standard of citizenship that has been responsible for America's unparalleled progress from our beginning. From the first we drew deeply from the Nordic strains of Northern Europe that in culture and rich heritage of tradition have contributed the

most desirable material to our national structure. We should be slow to abandon these sources from which so much of our great and good citizenry has come to us, and which have done so much to make possible our present civilization.

Let us hope that there is enough left of that old Colonial stock, which so bravely faced the real dangers of the ocean passage, struggled so valiantly to win for themselves a home and fireside on this none too hospitable shore, to maintain the best that we now enjoy.

The future of this nation, fast becoming the greatest in the world, is worthy of our best thought and effort. Let us firmly resolve that we will never cease to oppose forces that may in any way make for the lessening of that glory.

The immigration problem is one that requires broadminded, clear-thinking vision in order that we may preserve the rich heritage that our forefathers bequeathed to us and to those who are to follow us in the work of building a better civilization.

THE MENACE OF THE MELTING POT MYTH

HONORABLE ALBERT JOHNSON, Chairman Committee on Immigration and Naturalization, House of Representatives

The problem of Race Betterment, which is the subject matter for discussion at this Conference, is a matter of vital concern to every citizen of the United States. Perhaps for that very reason we have avoided its consideration. It is a problem that is fraught, however, with great practical difficulties.

History records that the Founders of the Republic felt keenly that the indiscriminate mingling of varied races and inharmonious cultures constituted a danger to the success of the great experiment that they had launched upon the seas of time. Despite this fact, and because of the sentiment that has existed among our people throughout the whole span of our history, a lack of general knowledge of all the factors involved, together with active obstruction by selfish interests, both business and racial, deterred Congress from any effective action along this line until the enactment of the first quota law in 1921.

Our ancestors discovered and applied principles of eugenics, although they did not call their action by so formidable a name, in the breeding of animals and plants. And to a great extent, I venture to say, progress along this line was made by practical men with scientific instincts, rather than by scientific men with practical instincts. However this may be, the crystallization of knowledge is of recent date, and must be credited to men of science, of whom there are present in this Conference many distinguished representatives.

But, while we can boast of great achievements already accomplished in the animal and vegetable kingdom subject to our control, we may as well frankly admit that, in respect to man himself, we have been lawless.

It needed a world cataclysm to bring to the consciousness of our people the menace that lay in the myth of the melting pot. We may have been unscientific in 1921, but I venture to say that had we not imposed a drastic inhibition upon a world migration to our shores, what we know as the American people and its institutions would have been submerged in chaos.

We have not finished with this problem. The sentimentalists and the internationalists, who see in miscegenation a beautiful prospect for

humanity, have joined with alien organizations to bring pressure upon Congress to break down the barriers we have so laboriously erected.

The Immigration Act of 1924 represents a distinct step in advance over its predecessors. We need your help not only in defense of its fundamental principles, but in the elaboration of further legislation for the Betterment of the American Race.

THE EVOLUTION OF THE AMERICAN POPULATION

Louis I. Dublin, Ph.D., Statistician Metropolitan Life Insurance Company.

The United States today contains the most rapidly evolved aggregation of people in the world. Few countries present so interesting and colorful a story of growth and development. Never before have so many different races and so many divergent traditions been blended into a single national entity. A biological and sociological experiment on a vast scale has been consummated with a success undreamed of by the founders of the Republic. Before it is too late and the record is blurred, it will be well to examine some of the important elements in the picture to see how they have interacted to make the composite we call *America.*

Obviously, we cannot hope to discuss completely the questions inherent in American demography, but we shall attempt to present the significant features in the composition of our people, their numbers, their age and racial groupings, their distribution over our farms and in our cities, the trend of our marriage and divorce rates, our birth rates and our death rates. These movements of population show clearly how the existing social fabric of our nation has been determined and what the future is likely to hold in store for us.

THE NUCLEUS FROM WHICH WAS FORMED OUR GREAT WORLD POWER

The period of settlement began in 1607 with the operations of the Virginia Colony, and continued for a century and three-quarters, when the United States came into being as a nation. During the first decades the colonies sprang up and grew like mushrooms, as shipload after shipload of colonists landed here. In fifty years, the settlers numbered fifty thousand. Conditions of life soon became easier and more stabilized, and the communities grew more from natural increase than from new arrivals from the old country. During the next one hundred and twenty-five years, a steady increase in numbers of about 35 per cent each decade occurred, or enough to double the population each twenty years. At the time of the first Federal Census in 1790, we numbered three and one-half millions. It is from this nucleus, scattered along the eastern seaboard, that the great world power of today with its one hundred and seventeen million inhabitants has grown. We have multiplied, therefore, about thirty-five fold in a hundred and thirty-five years. Our count has doubled, on the average, once every twenty-seven years during the life of the Republic.

The first seventy years were especially conducive to rapid multiplication. None of the usual checks to population increase were oper-

ative. Food was plentiful and there was elbow room for all. The frontiers of a new Empire were being extended to the western ocean. The whole nation reflected an expansive spirit.

A CHECK TO POPULATION GROWTH

The Civil War put a sudden and severe check to all this. Immigration and the birth rate both dropped and the death rate rose sharply. Never again was the country to see such increase as antedated the struggle between the North and South. Each succeeding decade has accentuated the tendency toward more moderate growth. The rate is now less than half what it was about a half century ago. Even under present conditions, however, the population of the United States should double in about sixty years.

PROBLEMS ARISING FROM IMMIGRATION

The rapid increase of the American people has resulted from two causes. The first is the excess of births over deaths; the second is the excess of immigration over emigration. The first of these factors was more important during the early history of the country; the second had its greatest influence in more recent decades. At the beginning, the American people were very prolific. Large families were the rule, the average number of children per family being seven or eight. On the whole, the country was an open and healthy one, and the excess of births over deaths was very great indeed. The multiplication of the native population determined the character of our national life and assured the maintenance of the political, legal and social institutions of the English founders. As the eastern seaboard became more thickly settled, a natural overflow of people moved over the prairies and established America as the great agricultural state. On the other hand, the immigration movement of the last sixty years located largely in our cities and was instrumental in developing our industrial system. American industry grew by leaps and bounds through the energy contributed by the recent newcomer. As a result, our cities are often foreign in character and outlook. A host of problems of maladjustment and of faulty assimilation have arisen with which our communities must contend. The more progressive now realize that they should translate America to the immigrant and in turn absorb the best qualities and traditions that the foreigner has brought with him from abroad.

THE PRESENT RATE OF URBANIZATION

America is rapidly becoming urban in character. In 1790 a negligible percentage lived in the cities. Forty years ago, thirty-five per cent of the population lived in such places and at present just over half of the population reside there. These cities not only attract almost all who come from abroad but also immense numbers of young natives tired of life on the farms. There are now six cities in the United States each with over a million people. The 83 cities of 100,000 or over together contain 37 million inhabitants, close to a third of the whole population. The tendency is distinctly toward greater urbanization. It is clear, however, that this movement cannot continue long unabated; for at the present rate of change, the entire population will have moved from the farms in less than two more centuries. Adjustments, however, are already in sight. The almost general use of automobiles on the farm, the building of good roads reaching out into every nook and corner of the country, the radio, the extension of cheap electric power to farms making possible the employment of farm machinery and of labor saving devices, together with the increasing prices of farm products, will make life there much more attractive. We need have no great fear of losing the source of our sustenance, although this great problem calls for immediate and statesmanlike consideration.

The northeastern section of the country contains the largest concentration of people, over 60 per cent of the total living in the states north of the Mason and Dixon line and east of the Missouri River. This area is still growing faster than any other. A little over 30 per cent live in the South. A little under 10 per cent live in the Rocky Mountain and Pacific states, although these contain more than half the land area of the entire country. Altogether, the United States is still a sparsely settled country. In 1920, it contained only 35 people per square mile, as contrasted with 701 in England, 184 in France, and with 328 in Germany. A density of population here equal to that of England would give us a total of two billion inhabitants. We cannot as yet talk of over-population in the United States.

THE RACIAL CHARACTER OF IMMIGRATION

The huge European migration to America during the nineteenth century was, perhaps, the most striking characteristic of the epoch. There are no official figures of immigration prior to 1820, but the movement was only a minor one. It increased after 1830, and passed the one hundred thousand mark for the first time in 1842. In 1846, the great Irish potato famine occurred, and during the next ten years more than a million and a quarter Irish immigrants came to the United States. A second large influx of Irish came over in the eighties. They

located largely in the cities of New York, Boston, Chicago and San Francisco, where they soon dominated the political life. A very large migration from Germany occurred during the same years and determined the character of many cities in the Middle West, such as Cincinnati, Milwaukee and St. Louis. England and the Scandinavian countries likewise contributed large numbers during the middle years of the century. During this period, those from northern and western Europe comprised almost the entire immigration.

In 1880, a significant change in the racial character of our immigration occurred. In that year, migration from Italy first became noticeable. In 1895, almost 300,000 Italians reached our shores. Simultaneously came the great increase in the number of Russians and Poles (particularly Jews), Czechs, Serbs and other inhabitants of southern and eastern Europe. This movement became more and more pronounced and, by 1896, the "new immigration" accounted for more than half of the total. The rapid growth of Pittsburgh, Buffalo and Detroit can very largely be traced to the Slavic contingent; while New York, Philadelphia and Chicago took on a distinctly Jewish and Italian appearance. In the years between 1901 to 1910, the last decade before the World War put a stop to immigration almost altogether, this immigration from southern and eastern Europe had grown to the amazing average of 72 per cent of the total. By 1920, the foreign stock, that is, those of foreign birth or of foreign parentage, amounted close to thirty-six and a half millions, or over a third of the entire white population. Of these, a fifth were from Germany, a little more than a tenth each from Ireland and Russia; Italy was a close follower with almost a tenth; Austria and Hungary together gave close to another eighth; England, Scotland and Wales, a twelfth. Less than 30 per cent came from a host of minor countries.

As a result of the recent immigration legislation, not only have the numbers of immigrants been sharply reduced but there has been a marked shift in the source of the newcomers. Those from northern and western Europe are now favored, while those from southern and eastern countries are almost entirely eliminated by the quota regulations. Immigrants from English-speaking countries once more represent almost half our annual net gain from immigration. Italians are actually declining in numbers because more are returning to their native land than are coming here.

EFFECTS ON LABOR

One of the first effects of the new immigration policy was the curtailment of the supply of common labor and especially of domestic servants. Before the War, European immigration furnished a very large proportion of such workers. Within the last few years there has been a large immigration of Mexican peons and of negroes from the southern farms and from the West Indies seeking to fill the gap left by the heavy reduction of European workers. Whether these will prove satisfactory substitutes for Europeans remains an open question and one that cannot be solved without seriously considering the ultimate effect upon social conditions in our northern industrial centers and upon southern and western agriculture. Especially will it be necessary to consider the effects of the curtailed supply of domestic servants on family welfare. Few as yet realize how potent this force is in reducing the size of families and in other ways mechanizing and drying up the sources of normal family life.

THE RÔLE OF THE NEGRO

No discussion of immigration and of race stocks in the United States would be complete without a brief reference to the negro and the rôle he has played in American life. The importation of negro slaves began in early Colonial days and continued on a huge scale for two centuries. By 1776 their number already had reached a half million. In 1790 they totaled over three-quarters of a million, or one-fifth of the total population of the country. Over 90 per cent of their number lived in the South and worked on the southern plantations. Each succeeding census has shown a marked increase in the colored population. By 1850 they had reached well over three and a half million; by 1900 almost nine million; by 1920, over ten and a half million; and at the present time they have attained the eleven million mark.

Even before the World War, they had migrated in large numbers to the industrial centers of the North and had found a place in various occupations the country over. But within the past decade, this movement has become sharply accentuated and today many northern cities such as Chicago, Detroit, Buffalo, Newark and New York have huge negro populations. Difficult racial problems have arisen and definite attempts at accommodation will need to be made.

The negro race, in any case, is holding its own in the keen struggle for existence. It is carving out a real place for itself in the national life, making valuable contributions not only in the arts but in a wide range of industrial pursuits.

THE ULTIMATE POPULATION OF THE UNITED STATES

The American people are still increasing in numbers. The annual additions from immigration amount to more than a quarter of a million, even under the present restrictive immigration law. The excess of births over deaths is still a million a year, or about one per cent of the total population. The birth rate is now 21 and the death rate about 12 per thousand. In the early decades of the nineteenth century, the birth rate was probably not less than 50 and the death rate around 20 per thousand per annum. Even fifty years ago the birth rate was close to 40 per thousand, or nearly twice as high as it is now. The present rate would be still lower were we not reaping the benefit of the relatively high birth rates of past decades. These give us a disproportionate number of persons in early adolescent and middle ages. Time and the new order will correct this situation, however.

Just how far our declining birth rate will go, it is difficult to say. Birth control knowledge is rapidly spreading to all classes of our society. This fact, coupled with the declining number of immigrants, who are for the most part young people, will undoubtedly retard the rate of increase. Consequently we may look before very long to a stationary, perhaps to a declining, population in the United States. Even with our low mortality rates, it requires an average of close to four children per mother for the population to reproduce itself, and there is only a very slight margin at the present time. If the present policy of restricted immigration and the sentiment favoring small families continues for another decade or two, our population will certainly become stationary in numbers. Much will depend, of course, upon the reaction of the public mind to the newer conditions. When these have become generally known and appreciated, it is entirely possible that the public attitude toward both immigration and the size of the family will materially change.

What the ultimate population of the United States will be remains an open question. Professor Pearl estimates that our maximum will be attained in the year 2100 and that it will then be close to 200 millions. Other estimates, based on the possible food production of an amount adequate to support a decent standard of living, indicate a larger maximum, reaching as high as 300 millions and even more. In the last analysis, the size of our population will depend on economic and social conditions in other countries, on the course of discovery and of invention, on the standards of living that our people demand, on the growth of our cities, on the productivity of our agriculture, and on other factors too numerous to mention. In view of the many uncertain variables, no one can prognosticate safely.

It is certain, however, that a rapidly increasing population goes hand in hand with a progressive and youthful spirit. Where the proportion of young people is large, marriage and birth rates are generally high. Young people have a progressive viewpoint and a marked capacity for achievement; they overcome difficulties; they hew out new paths; they try experiments and impart to a civilization an air of optimism and of cheerfulness. This contrasts with the more sedate and static atmosphere pervading a population either stationary or declining in numbers and one that is more largely peopled by old folks.

On the other hand increasing numbers produce a multitude of harassing problems. Cities grow so rapidly as to get out of hand, and intolerable conditions of congestion with their attendant evils result. The advantages of city life are often very dearly bought, and they will continue to be so until we learn how to plan our growing communities scientifically and to provide sound housing, transit and educational programs.

THE MAIN TRENDS OF FAMILY ORGANIZATION

We have thus far considered the composition of the population as a whole. We may now examine such facts as we have on the many sub-units or families that taken together make up the American people. It is the family that forms the foundation of civilized life and that determines the well-being, not only of the individual, but of the nation as a whole. It is somewhat disconcerting that our facts on the family are largely derived from Census returns, and that these do not quite correspond to what we might call "natural" families. Nevertheless, the Government figures will serve very well to show the main trends of family organization in our country.

In 1920, there were almost twenty-five million families in the United States, making an average of 4.3 persons in the family group. There are now approximately twenty-seven and a half million families. The size has been decreasing slowly and regularly since 1850, when there were 5.6 persons in the family. The largest families are found in the South; the smallest on the Pacific Coast; the other geographic areas show very little variation from the average. In general, the urban is smaller than the rural family. It would be interesting to know the size of families classified according to the color and nativity of the parents; but, unfortunately, these figures are not available. We do know, though, that families of immigrants are usually much larger than those of our native stock except in the rural South and Southwest where large families still prevail.

INCREASE IN MARRIAGE RATE

Families are formed through the institution of marriage and are broken by death, divorce or separation. In 1925, there occurred in the United States 10.2 marriages for each thousand of population. Since every marriage involves two persons, this means, in effect, that there is each year one marriage for every fifty people in the United States. In 1887, the first year when marriage statistics became available for the country as a whole, the rate was 8.7 per thousand. Since 1905, the crude marriage rate has been above 10 per thousand. It is safe to say that, on the whole, the marriage rate has increased slowly but consistently during the last forty years. This increase, moreover, is manifest at every age division of life.

INCREASE OF AGE AT MARRIAGE

There has also been an increase in the average age at marriage as shown by the figures for Massachusetts. In 1926, the average age of marriage of men was 29.5 and of women, 26.1. Both of these figures are a half year higher than they were only sixteen years ago. The highest marriage rates occur in the southern section of the country, Florida showing the highest figures. Delaware, on the other hand, shows the lowest. The figures vary somewhat from state to state according to economic conditions, the age constitution of the population, the prevailing industries, and other characteristics.

COMPARISON WITH OTHER COUNTRIES

Our marriage rate of a little over 10 per thousand people is fairly high as compared with other countries. England and Wales in 1924 showed a marriage rate of 7.6; Germany in the same year showed even a lower figure, namely, 7.1. These low figures reflect the unfavorable economic conditions in these countries since the War. Women at the marriageable ages are in great excess in both of them. It will require several decades of peace and prosperity to restore the balance. The opportunities for marriage in America are undoubtedly very favorable, both because of the age and sex composition of the population, and because of the excellent economic situation now prevailing throughout the country. Marriage rates are among the first to reflect the state of well-being of the people, rising and falling with conditions of employment and wage levels.

COMPARATIVE MORTALITY RATES

The same conditions that make our marriage rates high have made our death rates remarkably low. The mortality rate here has always been favorable as compared with that of other countries. The American people were recruited from hardy stock. After the country was

settled, conditions of life were, on the whole, conducive to longevity. But few official figures on mortality are available for the formative years of the Republic. The general death rate was probably about 20 per thousand in normal periods of the early days. When, as often happened, epidemics of various diseases, such as smallpox, yellow fever and cholera, prevailed, the rate shot up to 30 and even 40 per thousand. The rates were higher in the cities than on the farms, although on the southern plantations malaria could often be counted on to increase the mortality.

THE CONTROL OF INFECTIOUS DISEASES

The development of the public health movement beginning, say, fifty years ago, changed the situation. Under the direction of health workers and the medical profession, infections came gradually under control. The sanitation of our water supplies, the protection of our milk and food supplies, popular education in personal hygiene, the training of mothers in the care of their babies, the improvement in conditions of labor, the extension of our cities and the building up of suburbs —all these activities have had a marked effect in reducing the mortality and in increasing the span of life. The death rate has been reduced at least sixty per cent during the last forty or fifty years. In 1900, the first year of official death registration, the rate was 17.6 per thousand. In 1925, the death rate was 11.8, representing a fall of 49.2 per cent in a quarter of a century.

To be sure the improvement that has brought this mortality figure down has been largely concentrated within the younger ages. Infant mortality is less than half what it was twenty-five years ago. Then one out of every five babies born died before it was a year old. Now we find fault when one out of every fourteen babies dies in its first year of life. The mortality of children in their teens, of school children, of adolescents, and even of young adults up to age thirty-five, has shown considerable improvement. Tuberculosis has been markedly reduced as a scourge of young and even of middle-aged people. Typhoid fever, diphtheria, scarlet fever, all have rapidly diminished. They promise to become, ultimately, as rare as yellow fever and cholera in the United States. The outlook for the future is very promising indeed.

THE INCREASING EXPECTATION OF LIFE AT BIRTH

The effect of the reduction in mortality has been to lengthen the average duration of life, or what is technically called, the expectation of life at birth. In 1840, it was only 40 years. Since then the expectation has gradually crept up until now it is about 58 years. The gain is close to fifty per cent in this comparatively short period of

time. Only the people of Australia and New Zealand enjoy a longer expectation.

One point must be made clear, however. The lengthening of the life span, that is, the capacity to live long, has not increased. We probably do not have proportionately more centenarians than in the early years. What has happened has been to make a long life possible for a greater number of people. The wanton extinction of hordes of babies and of young people before they had more than tasted of life has been stopped to a marked degree. What this has meant for the happiness and prosperity of the American people can scarcely be estimated.

LESS DISRUPTION OF FAMILIES BY DEATH

Death is the great disintegrating force when it hits the family, especially the father. The effect of this tragedy on the family is tremendous, throwing every activity of normal life out of gear. The death of the young father ushers in a whole series of calamities that tax every resource of the community. Only a comparatively short time ago the welfare agencies were largely concerned with the consequences following upon the premature death of parents. Tuberculosis was one of the major causes leading to the necessity for charitable relief. Only fifteen years ago the death rate of young married men in New York State was nearly three times as high as it is now. Very much the same situation existed with reference to young and middle-aged married women. Under present conditions, the mortality rate has been so far reduced during the first ten or fifteen years of married life as to become a relatively minor factor in the disruption of families.

THE DIVORCE EVIL NOW A MAJOR PROBLEM

The break-up of families through divorce has become increasingly more frequent with the passing years. In 1925, there occurred more than one hundred and seventy-five thousand divorces in the United States. This is at a rate of 1.5 per thousand total population, or one divorce for each seven marriages in that year. The rate for 1925 was three times as high as in 1887 when divorce registration for the whole country began. The frequency of divorce is now a major problem in our social economy and the evil is rapidly getting out of hand. In certain social classes, divorce has become the fashion. Few realize how serious the situation is because it is as yet largely concentrated among persons enjoying ample means. But, unfortunately, such tendencies always percolate into other economic levels. What is the mode in one class one year is copied by another the next. As might be expected, children are relatively rare in families broken by divorce. There were

no children in 57 per cent of the cases, and there was an average of only 1.8 children in those divorces which reported any children.

The divorce rate is highest in the southwestern states, including Arkansas, Louisiana, Oklahoma and Texas. There were 6.5 divorces per thousand married persons in 1925. The lowest divorce rate was recorded in the Middle Atlantic States, which include New York, New Jersey and Pennsylvania, where 1.5 divorces were recorded per thousand married people. There is, however, uncertainty as to the value of these figures because of the ease with which individuals can obtain divorces in other states than those of their usual residence. In Nevada the divorce rate was 34.7 per thousand married population. This high figure obviously reflects the peculiar legal situation in that state. Oklahoma, Oregon and Texas also show high rates. The lowest divorce rates prevail in the State of New York, less than one per thousand married population, and in the District of Columbia.

AVERAGE CURRENT FAMILY INCOMES

Brief as our treatment of American demography must be, we cannot entirely omit a reference to the occupational distribution of our people and a word or two on the salaries and wages earned by them. Ours is a nation of workers with a negligible proportion of drones. In spite of great national wealth, we have maintained the early tradition of respect for those who work. According to the latest estimates, there are forty-three million gainfully employed persons in the United States, who constitute 37 per cent of the total population. They are the income producing members of twenty-seven and a half million families. There is, therefore, an average of 1.6 wage earners to each family. We should really add to this figure the more than twenty million housewives who are engaged in equally useful work, and the millions of children and young people who are at school. But these two groups are ruled out by the arbitrary definition of the word "gainfully" employed. There are, however, many mothers and adolescents in this period of unparalleled national prosperity who are engaged in gainful pursuits. Approximately two million married women and about two million seven hundred and fifty thousand children, 17 years of age or younger, are engaged in gainful occupations. In the last decade, there has been an encouraging decrease in the number of children employed in industry. The number of married women in industry, on the other hand, is steadily increasing, except in agriculture and domestic service. How many widows there are in gainful employment we do not know, but they undoubtedly form a substantial group.

During the greater part of our national life, agricultural workers constituted the largest single group of gainfully employed persons. In the last fifteen years they have been supplemented by those in manufacturing and mechanical pursuits. According to a recent computation, the 43,000,000 gainfully employed persons are divided among the main industrial classifications as follows: Manufacturing and mechanical pursuits, 12,820,000; agriculture, 10,500,000; trade, 4,600,000; clerical work, 3,820,000; domestic and personal service, 3,590,000; transportation, 3,280,000; professional service, 2,370,000; mining and quarrying, 1,150,000, and public service, 780,000.

A vital factor in family as well as in national well-being is the amount and purchasing value of the income derived from labor. This determines largely the peace and effectiveness of family life. It would be instructive if we could give the average earnings of workers in each of our occupational classes. But no reliable data are at hand. We can at best give only rough estimates for very large groups. The total national income from all sources in 1921, the latest year for which data are available, was approximately eighty-four and a half billion dollars. This divided by the twenty-five million families of that year gives an average of close to $3,500 per annum. This figure covers all classes of the community and includes income from all sources. More important is a consideration of the income in those families that are largely, if not entirely, dependent upon wages and salaries. In 1921, the total income derived from salaries and wages was thirty-four billion seven hundred million dollars. The figure for 1926 is probably twenty per cent higher, making a total of about forty-one and a half billions of dollars from this source. As there are approximately thirty-three and a half million workers whose chief or only source of income is derived from their labor, the average salary or wages of these people is $1,240 a year. This figure must, however, be increased by 60 per cent to cover all members of the family gainfully employed, which makes a total family income of close to $2,000 per year. In addition, a sum of approximately $300 may be added to the average to include such income derived from interest, gifts, legacies and other sources. In other words, we may estimate that the average current income of such families is approximately $2,300 a year.

But this average for wage earners and salaried families must be considered with some caution. Possibly 80 per cent of the families we are considering have less than the average figure per family and only 20 per cent have this amount or more. The latter group includes families of professional men, of officials, managers and superintendents in various industries. A recent estimate of the earnings of physicians,

for example, shows an average income of from $3,000 to $3,500 a year. Other professions show similar levels. Here, too, are included the families of men in the skilled building trades and in other skilled employments where wages are high.

DECREASING UNEMPLOYMENT AND ILL HEALTH

It is the large number of families whose incomes are below the average with which we are more particularly concerned. In this group should be included the families of laborers, and of semi-skilled workers on the railroads, in agriculture, in the building trades, in the mines and factories, as well as in domestic and personal service. These families live fairly close to the margin of subsistence. A case of continued illness, of serious unemployment, or such a contingency as the death of the wage earner, will, in many instances, force such families to seek charitable relief. Fortunately, the high degree of industrial activity that we have enjoyed in recent years, and the decreasing proportion of unemployment and ill-health, have resulted in remarkable advances in economic well-being. The condition of the American people is now better than ever before in our history and is unquestionably the most favorable in the world.

OUR HISTORY FORECASTS A BRIGHT FUTURE

The history we have tried to trace of our origin and growth has valuable implications for us today in our effort to cope successfully with important problems. The clearest fact in our national life is that at bottom we are a nation of foreigners. The constituent elements differ only according to the length of their American domicile. Our history has proved, however, that peoples of various races, of diverse traditions, customs, religions and languages can live together in peace and prosperity and can build up a nation of striking unity and solidarity of purpose, and that this can be accomplished within the space of a very few generations. Our apparently haphazard immigration, which might easily have produced insurmountable obstacles to national unity, has luckily resolved itself into an orderly pattern. A new physical type, as well as a new spiritual concept of how different peoples can live and work together harmoniously, has been evolved. The opportunities offered the newcomer have been wisely used. He has played fair and has given of his best. He has often personified the best American tradition, appreciating to the fullest the meaning of liberty, probably because he has only so recently acquired it. The events of the last century and a half, in spite of occasional lapses and backslidings, have demonstrated the validity of the aims that animated those who framed the Constitution and who conceived a nation serving the oppressed

peoples of the world and offering them equal opportunities for self-development, irrespective of wealth, race, color or creed.

Our history likewise forecasts a bright future for our country. The wise development of our splendid natural resources and our increasing industrial efficiency should insure a generally high standard of living. In a land like ours, there should be no poverty with its attendant evils. The further extension of the public health program will bring better health and longer life with increased production and efficiency. Wider educational opportunities with increasing leisure will give deeper meaning to our lives. There is a real opportunity in America to demonstrate to the older civilizations of the world the great possibilities inherent in the common man. It is clearly the lesson of our past that under a favorable environment, operating through democratic forms, a happy and creative people can be evolved. There is no need to breed a race of supermen.

BRIDGING THE GULF TO THE AVERAGE MAN

MICHAEL KLEY, Manager of the Immigrant Service and Citizenship Bureau of the Metropolitan Life Insurance Company

There have been presented at the Conference remarkable studies of scientific import treating with biological, bacteriological and chemical phases of human living. I was assigned the subject of the foreign born, but as this is a Race Betterment Conference, I realize that the foreign born are the parents of the first generation of native born, and you cannot tear families apart that way, racially speaking. So my subject grew to a consideration of the foreign born stock in this country. But I was at a loss how far back a man must go to find the purely native stock, since the nation has been evoluting from its earliest days from immigrants and the further you go back the nearer you come to the immigrant ancestry of the native American.

I then referred to the announcement of the Conference which states as its purpose "to bridge the gulf that now exists between the expert and the average man, and to release in behalf of everyone some of the scientist's expert knowledge of factors that make for health, long life and well-being."

I have taken as my topic, "Bridging the Gulf to the *Average Man*" using the term to mean the mass of the people, and that will include a consideration of the foreign born. I shall endeavor to present, in the limited time at my disposal, an educational approach to the foreign born and his native born brother of the working population, with a view to interpreting and applying scientific knowledge for the promotion of health and physical well-being. I shall deal only with the social and cultural factors of this problem.

THE CHARACTERISTICS OF THE "AVERAGE MAN"

Let us for the moment inquire into the composition and characteristics of this "average man" in the United States. We may take for this purpose as our most available guide the Federal Census of 1920. We find here detailed statistics interpretive of the racial composition and characteristics of the American people. The "average man" might be any one of the fourteen million foreign born that were recorded as in this country in 1920, to which number we must add three million new arrivals to bring it up to date. These seventeen million people are the nucleus of the foreign stock population. Radiating from it and closely allied in social interest are fifteen and a half million native whites of foreign percentage, and then, somewhat further from the center, a narrow

circle of seven million native whites of mixed parentage—in a word, then, thirty-nine million foreign born white stock or their immediate descendants. Seeking further, you might find this "average man" among the million and three-quarters foreign born white illiterate, or he may be one of the million and a quarter native born white who are listed as illiterate. Continuing in our quest, he might be one of the 335,175 immigrants, or newcomers for permanent residence, admitted into the United States during the past fiscal year. Taking the racial background into consideration, he might be one of the two million Italians, million Poles, Germans, Russians, Swedes, Greeks, and forty odd other nationalities of our heterogeneous population. From an occupation point of view, he might be a butcher, a baker, a steel worker, a garment operator, a farmer. And, to complete the analysis of the "complexion" of the American population, the "average man" might be just a plain, everyday American of native parentage with no outstanding reason for particular study.

THE FOREIGN BORN

The immigrant foreign born and their immediate descendants afford a unique field of study and endeavor. They are an integral part of our national being. And yet, because of their distinct racial and cultural backgrounds, their problems of economic and social adjustment, their language difficulties, their living habits and other characteristic factors, the educational approach must be effectively adapted to meet their special needs.

The foreign born population must be taken into account in any consideration of Race Betterment. They form a large proportion of our industrial population, such groups ranging from 15 to 40 per cent in industrial centers. Though the foreign born form but 13 per cent of the population, they are 28.7 per cent in Rhode Island, 28.0 per cent in Massachusetts, 27.3 per cent in Connecticut, 26.8 per cent in New York, 23.4 per cent in New Jersey, 20.6 per cent in New Hampshire, 20.4 per cent in Minnesota, 20.3 per cent in North Dakota, 19.8 per cent in Michigan, 18.6 per cent in Illinois and 17.5 per cent in Wisconsin. The proportion of foreign born in four large cities may give some idea of their composition: New York has 35.4 per cent foreign born; Chicago 29.8 per cent, Boston 30.9 per cent, and Cleveland 30.1 per cent.

For the particular information of this Battle Creek audience, it may be interesting for them to know that the City of Battle Creek, in which this Race Betterment Conference is being held, had a population of 36,164 in 1920. It is now over 47,000, but the population data will be proportionally the same. Of that thirty-six odd thousand, 3,378 were

foreign born, 3,072 of foreign born parentage, 3,212 natives of mixed parentage, making a total of 9,662 or a quarter of the population foreign born stock. The composition of your residents included Italians, Poles, Russians, Germans, Greeks, Armenians, Jugo-Slavians, Mexicans, Dutch, Hungarians, Bohemians, Norwegians, Austrians, Bulgarians, Danes, Finns, French, Roumanians, Swedes, Swiss and Syrians. This information is given in no critical spirit, but only as statistical data, showing the complex nature of the problem of race improvement. As Mayor Bailey pointed out, this is a city of homes and the majority of these people have been assimilated and absorbed into the community life of your city.

THE GULF BETWEEN THE EXPERT AND THE AVERAGE MAN

This is the scene that presents itself to the mind of the student seeking a practical way of bridging the gulf between the expert and the average man. It is our purpose to inculcate into the minds of those who haven't it the knowledge that the scientist has wrought out of years of experiment, research and demonstration. This scientific information is considered beneficial to the individual, and its application to everyday living would materially improve the physical well-being of the nation.

Assuming that scientific knowledge for Race Betterment is made available, the question that arises is what method or procedure must be adopted to carry the information across the gulf to the average man. What is the medium of approach to the foreign born population and their immediate kin in our midst, for example. The highly schooled are apt to forget—they certainly do not deliberately ignore—the presence of these millions of our people whose physical welfare as constituents of our population, as much as any in the land, it is our desire to promote and foster.

The gulf seems to offer no end of difficulties. On the one side are the scientists and educators—those who know; on the other, those who do not know or do not understand. Suppose you succeed in spanning the gulf, and in translating or conveying the results of the scientist's labor to the erring millions on the other side. That would not solve the problem. Mere transmission is not sufficient. It is but an initial step in the process. We must ascertain also whether or not this knowledge is being practically applied, and gauge its effectiveness in resultant benefits to the individual and nation. We have here, then, a program of education. Let us analyze the steps:

A PROGRAM OF EDUCATION

I. True scientific knowledge must be conveyed. Matters in controversial state are useless and destructive. What you say must have clear scientific demonstration to back it.

II. You must interpret this knowledge in a language that the people will understand.

III. There must be sympathetic transmission, that is, you must convey the knowledge at the appropriate time and through a sympathetic agency.

IV. The recipient must utilize the knowledge and apply it to his or her particular need and well-being.

V. You must gauge and establish the cumulative value of this knowledge in terms of human betterment.

Now the promotion of public health and hygiene is essentially a state function. Since the development of the public health movement, impressive progress has been made through the United States Public Health Service, state and local health officers and associated public health agencies in the elimination of preventable diseases, teaching of personal hygiene and general health promotion. But it is a fact that whereas the community spends between $1 and $3 per capita for its fire and police department in the protection of physical property, the average expenditure throughout the United States last year for health promotion and conservation of human life was only thirty cents per capita.

It devolves upon large business corporations, therefore, and upon semi-public agencies, to carry the burden of insufficient public appropriations and to set an example of what may be done in health betterment by adequate expenditure.

A CAMPAIGN OF HEALTH EDUCATION

For the past eighteen years, under the inspiration of Dr. Lee K. Frankel, the Metropolitan Life Insurance Company has been carrying on a campaign of health education among its policyholders. Of the twenty-five million people insured in this company, approximately twenty-one million are industrial policyholders, essentially of the working population, more than half of whom belong to the foreign born stock that I have tried to visualize for you at the beginning of this paper. Included among them are the varied racial groups that have not yet fully adjusted themselves to our language, customs and living standards.

Realizing that these millions of industrial policyholders have little opportunity of knowing the more advanced scientific thought on per-

sonal hygiene and health, we have worked out a means of approach and a method of interpretation in an educational program for longer life and well-being. The human agency used to carry out this program is closely allied in social condition and interest to the people affected. It is the agency force of the company acting as health messengers. This trained staff of nearly twenty-four thousand men makes over 500 million visits a year to the homes of the working people of America and Canada. The agent enters the home each week on a mission of mutual service. He is known and trusted by the family. Often he is of the same nationality as the policyholder and speaks his language. This human agency is used in the broadcasting of a popular interpretation of all important facts—scientifically demonstrated—that make for longer and better life.

This interpretation of science in terms that the common people will understand is contained in over a hundred attractively printed booklets dealing with child care, preventable diseases, personal hygiene and varied topics of immediate physical interest to the human being. They are available in simple English and in a dozen foreign languages. Nearly five hundred million of these booklets have been carried into the homes by the agency force as a phase of the health promotion program.

DEATH RATES REDUCED BY HEALTH DEMONSTRATIONS

Supplementing this activity is a free nursing service to industrial policyholders in over 4,250 cities and towns in the United States and Canada. Thirty million nursing visits have been provided to these people in the past nineteen years. The nurse not only gives bedside care but, what is more important in the carrying out of the educational health program, she instructs all members of the family concerning disease prevention, home hygiene and related subjects.

In addition to the nursing service and popular interpretation of scientific knowledge, the company has endeavored to contribute to science through experiment and demonstration, for example the Framingham Demonstration, where an effort to control tuberculosis resulted in a drop of the death rate from 121 to 38 per 100,000 in a seven-year period; also, the Thetford Mines infant welfare experiment, in which a demonstration of methods of child care and infant mortality resulted in a drop in the death rate from 300 to 96 per thousand born.

Motion pictures dealing with periodical health examination, diphtheria immunization and smallpox prevention have been shown to millions of people. For work with schools, parent-teacher associations and women's clubs, special literature, film exhibits, posters and other

material are prepared and distributed, all with a view to reaching the mass of the people directly.

What have been the results in terms of health to this industrial group of twenty-one million people?

A CUMULATIVE SAVING IN MORTALITY

In 1911 the general mortality of the industrial policyholder of the Metropolitan was 24.3 per cent higher than the mortality of the Registration Area of the United States as a whole. This was to have been expected, dealing as we were with the working people, with their hazards and lower living conditions. By 1925 the mortality rate of the Metropolitan policyholders had improved at such a rate as to bring it 1.3 per cent under the rate for the Registration Area.

From 1911 to 1925 the average duration of life for the country as a whole increased by 5.1 years. For Metropolitan industrial policyholders this increase was 8.8 years. In other words the general mortality rate among this Metropolitan industrial group improved so much more rapidly than that of the general population as to result in a cumulative net saving in mortality, in excess of the general population improvement, of approximately 275,000 lives.

I have given these facts and quoted the figures simply as a record of a practical demonstration by a public institution having contacts with the masses of the people. In conclusion may I say that, given available scientific knowledge covering longevity and Race Betterment—and the remarkably enlightening papers of the Conference indicate the large amount of valuable data that are available—we can bridge the gulf between the scientist and the average man by meeting him on his own ground, in his own home and through the medium of trained people of his own class and social condition; by interpreting scientific knowledge in a language he can understand and act upon; and thus aid, through a practical educational program among the masses of the people, the development of longer life, well-being and, indirectly, Race Betterment.

SCIENCE AND THE WORKER

Honorable James J. Davis, Secretary United States Department of Labor, Washington, D. C.

It has been said of ancient civilizations that only because the millions were forced to do the work could the few find time to think. Today nearly every laboring man in the United States has "time to think." And he owes this mostly to science.

The other nations of the world today are justly proud of what they have done and where they stand. Their past and present is sprinkled thick with the names of great artists, musicians, poets, scientists and inventors. And beyond all doubt these great thinkers have vastly enriched human life. Yet I cannot help thinking that their great achievements have been mainly for the benefit of the people of leisure and cultivation.

It seems to me that only here in America has the life of the working man been really enriched. It may be that America has yet to take her place in the realm of art, but if that is so it is because America has been engaged in another and greater art. It seems to me that the great work America has done is to take science and invention wherever she finds them, and put them to practical benefit for the man who works.

The great art America has developed is the art of wiping the sweat from the laborer's brow, the art of lifting from his back the burdens that have weighed him down through countless ages. Even in our own short history he used to toil from sun to sun—in the field, in factory or shop, or under the ground in mines. He faced dangers in the mine. In the factory he had his back-breaking weights to lift. His tools were poor, his pay was little, his hours were long. When they were done, in the language of the street, he had nothing to do but rest—if he could.

THE WORKER HAS ENJOYMENTS UNKNOWN TO THE KINGS OF OLD

From that we have freed him. We have shortened his hours, lightened his labors. He used to need muscle, and we have given him endless steam and electric power instead. He used to need a hand craft that it cost him years to acquire, and we have given him machinery of wonderful cunning. With power and machinery one man produces with ease more wealth than hundreds produced with back-breaking and heart-breaking toil. And he shares in the wealth he produces in the form of higher wages than workers were ever paid before.

For the first time in history we have not only given the worker "time to think;" we have given him things to think of, and an education to help him in his thinking. We have given him enjoyments in life unknown to the kings of old. And we have given him ample means to buy and possess these enjoyments. All this is the work of science. This is what is meant by the application of science to industry.

Science is as old as history itself, and has grown to be a great and many-sided thing. Other peoples have played their part in its development. But I believe it has fallen to America to develop the highest science of all. I mean the science that takes all the other sciences and puts them to practical use for the benefit of men—the benefit of every man. I mean the Science of Management.

You learn what it is by what it does. It is the science that has made us the richest of peoples. It is the science that has put within reach nearly every good thing of life, for all to enjoy alike—the automobile, and the broader life it brings; the well-warmed, well-furnished home—the list is endless, but the worker begins to have all of them.

A SAMPLE GIFT OF SCIENCE TO INDUSTRY

It is not so much the mechanical and chemical wonders that science performs today that interest me most. It is this effect that science has had in a social way, in opening life in all its fullness to those who throughout the ages never knew life at all. To appreciate what we have today as the gift of science, to see this blessing to men in all its tremendous scope and significance, you have to measure it against the struggles that men, and especially the working men, have had in the past.

If you do look back, you will be struck with pity. Your pity will be not only for the hard lot of the ancient slave or menial, but for his struggle to better that lot. You will also wonder at his ingenuity. It seems that from the very beginning of things men have groped for this or that invention to save them work, cure their ills, and make life better.

For example, an enormous ant exists in parts of the South American jungle. One type of this ant has powerful pinchers or claws. When he sinks them into anything, these pinchers lock. They stay locked even after the death of the insect itself. Nothing, in fact, will unlock them but some mechanism within the insect. This fact the primitive Indians of Guiana discovered and put to use. When one of them suffered from a serious wound, a few of these ants were allowed to grip their claws through the sides of the cut and bring them together until they had healed. In a way, that was science.

But from that primitive surgery, see the distance we have come. Dr. Albee of New York will take a piece of your shin bone and weld it into your arm or any other bone of the body that is broken and refuses to heal. Between that feat of Dr. Albee, and the ants of the Guiana Indian, lies the whole gamut of science in surgery. And all this is now at the service of the man who works. For Dr. Albee has applied surgery to industry as it has never been done before, and the science of management has helped him—for legal science in our compensation laws has made it pay to get the injured worker back on the job as soon as possible. The science of the law has done that because the science of economics has taught us how necessary it is for us all to be producers every minute of the time.

Today it has become almost silly to say that a man is hopelessly crippled or can not recover. We have almost stricken the word despair from the dictionary. In surgery alone it has been discovered that the shin bone is the one bone in the body that if removed will replace itself. The fact that a bone from an individual grafted or welded onto another bone elsewhere in the same individual is more likely to heal than a bone from another source, has developed the further fact that each human being has within himself a factory for the manufacture of the material to heal his own broken, crushed, or diseased bones. So "Albeeism" has come to mean, in a measure, the end of hopeless cripples.

I cite this only to show what is going on everywhere in science. The same progress as in surgery, from the ant of the jungle to the art of Dr. Albee, runs through industry in general. You see it in sanitation, in devices to protect the worker from dangerous machines, from health-destroying chemicals. In my estimation, that is one of the finest sciences of all. It is not enough to help a man to produce as men have never produced before. The great job of science is to make life itself better than ever, and to see that every man has his full share of it. And the achievements of Dr. Albee are only a single proof that science is doing just that.

NO LONGER "THROUGH" AT FORTY

As the scientists find new ways of meeting disease and lengthening life, I foresee the worker living a longer life of usefulness. Too many employers have still the notion that a worker, no matter what his record or what his present skill, is through at forty. When I was a youngster at work in the iron and steel mills, the man who reached that age was given a gold-headed cane—and his discharge. His years of willing work, the contribution of his skill to the enterprise that employed him, earned him a little thanks. After they were spoken, the enterprise had no further use for him.

Science, I believe, will drive this foolish notion out of our heads. It will stretch out the worker's period of worth and ability to work. And that work itself will ever be lightened by new and more wonderful automatic machinery. Instead of turning the still valuable worker away at fifty, an age we now regard as hardly more than middle life, I believe we shall be proud of keeping the man of seventy still usefully employed. The fact will be noted that he is still strong, healthy and able. His hand will control the new automatic machinery as well as a man of thirty. And a more enlightened employer will not see a liability in that man's years, but rather an asset, in the added skill and experience his longer life of work will have given him. That, I believe, will be the order of things in the near future.

SCIENCE THE CONQUEROR OF HUMAN SLAVERY

We who live in this age too little realize what has been done for us, and the long labors of science in order to bring us these boons we enjoy. As it is, we little appreciate the debt we owe to the pioneers of science long, long ago. Only yesterday invention gave us the aeroplane, yet hundreds and possibly thousands of years ago a savage race, who knew nothing of the laws of air resistance and pressure, developed a weapon that remains a marvel of skill to this day—the boomerang, a wooden blade so shaped, curved and sharpened as to return to the hand of the thrower after being flung at an object a hundred yards away. For its day and age, the boomerang was a more remarkable instrument than the flying machine of today. It was by no means as useful, but it represents that inherent ingenuity in man that has brought us to the exact knowledge we have today.

It seems you will find man that busy inventor at all ages. When Caesar conquered the Germanic peoples, he found them using a machine for harvesting their wheat. A pair of oxen pushed it through the grain. Less than a generation ago the same type of machine was used here in America and known as the header. A revolving wheel bent the heads of wheat over a row of fingers or slots that tore off the grain as the machine was pushed along. Thus a harvester better than the one known to our grandfathers had been developed by a people the Romans regarded as "barbarous."

WHEN SLAVES WERE CHEAPER THAN MACHINERY

I cite this for a reason. When Caesar conquered those inventive people, slavery was introduced among them. The result was that the machine passed out of use. It was cheaper and easier to force the slaves to do the work. A good slave could be bought for $5, and that harvesting machine disappeared for centuries. What better proof could

we want for the fact that the real conqueror of human slavery is science with its machinery. If you want to see at a glance what happens when science is *not* applied to industry, you see it in Caesar's blow to that promising invention.

The truth is that the ancient peoples knew more than we give them credit for about the mechanical laws we have forced to serve us in such stupendous fashion. More than a century before the birth of Christ, a man named Hero had invented a primitive steam engine. And again a mechanical device that might have led to the more rapid advancement of man was blighted by a less fortunate human device. Once more the abundance and cheapness of human slaves entered in, and Hero's engine remained a curiosity in a museum. Once again you have to pity those ancient peoples. You marvel at their beginnings in science. You pity them because they could not see what science could have done for them if they had let it free their slaves and do their work.

This same thing occurred in Rome itself. Water power was used in many Roman pottery plants. But it was used simply to help the slaves in turning the wheels that furnished the power. Those Roman pottery manufacturers were right on the edge of discovering automatic water power, and they never knew it. Once more the cheapness and abundance of slave labor blinded their eyes.

In the history of chemistry you find the same sad story. The spade of the explorer has turned up Babylonian tablets bearing five different recipes for the making of glass. Not only is the formula given, but the process of manufacture is described. The wonderful part of it is that the glass mixed in Babylonia 3,000 years before Christ is the same as the glass of today, except that the Babylonian glass was rough where the laboratory has given us the vastly refined glass of today. But today marvelous machines turn out our glass, so that thousands of workers whose lives used to be shortened by the heavy work of blowing it are released to other pursuits. In Babylon, of course, nobody cared if a $5 slave died early. His place was quickly taken by another $5 purchase.

TODAY WE "BUILD ROADS" OF HUMAN PROGRESS

I can think of only one activity in which science has not placed us far, far ahead of the ancients. This is in road-building. Today we build roads overnight. We wear them out nearly as fast. But that is because, in this modern day, we subject them to loads and usage unknown in the long ago, unknown even twenty years ago. The roads built by the Romans when Christ was a boy are still in use. Those Romans were willing to employ hundreds of thousands of men for many years in building a few miles of roadway. It is little wonder that

the highways they constructed have lasted for thousands of years. Whether even their great roads would have lasted, however, if subjected to wear and tear from the thundering thousands of trucks and busses that rush at high speed over our concrete ways, is doubtful. But the chief point about the Roman road is, once more, that it was built by slave labor, and the labor broke the slaves.

What an enduring road for human progress we have built instead! In Roman days slave labor was too cheap to waste time on machinery. Today human life is too valuable to waste when machinery is so cheap and efficient. That is the road we have traveled, with science to lead us. And what an immense distance we have come!

HOUSES MAY BE BUILT IN THIRTY HOURS

In the fifteenth and sixteenth centuries, the people of England were building houses of stone. Even the partition walls were built of stone, some of them three feet thick. Some of these structures are standing today, and people still live in them. But not one of these houses had window glass. They had no stoves, no ventilation, not one of the things the humblest workman regards as necessary to a home.

One of the reasons why those old houses still stand is because it would cost more to tear them down or to blow them up than it would to build a modern house on the same foundation. Today we build a house made in sections in a factory, so that they can be fitted together in thirty hours. Or we frame our houses of steel and pour concrete about them, in almost as short a time. In almost as short a time we can tear them down, if an elder daughter gets the notion that the place is old and stuffy and we ought to have a new one. But while we let our houses stand, the steel and concrete in them makes them stronger than the three-foot walls of Old England.

Our houses may stand, but we ourselves do not. You will see improvements in building every day. In the first years of steel construction, the pneumatic riveter did its work to perfection, but it let out a terrific noise while it was at it. Now science has turned to the welding of structural steel by means of the acetylene and electric torch, and one arc welder now does the work of eight or ten riveters.

MORE MACHINERY HAS MADE MORE JOBS AT HIGHER WAGES

The great stimulus science has received in the invention of new machinery has been high wages. Yet hand in hand with the science of mechanical invention has gone a science of another kind. Each new labor-saving machine has thrown some numbers of men out of work. For a while these have had a temporary set-back until they could fit themselves into new occupations. But the very machinery brought

about by the high cost of human labor has made more new jobs for more workers at higher wages than ever. There, again, is human ingenuity at work. As fast as we improve the manufacture of the older commodities, science and invention step in to create new commodities and new demands for them.

You can see this at work in the linotype machine, which does the work of four to six of the old-fashioned hand type-setters. For a short time there was disturbance in the printing trade as a result of the introduction and spread of this machine. Yet, in a very brief period, the actual result of this machine was to cheapen the production of printing so that great numbers of people were able to buy printed things and to enjoy reading—a pleasure they had never had before. A new profit and enjoyment was let into their lives. So many more people rose to this new opportunity to improve themselves that the printing trade expanded, and thousands more printers are now employed than during the old days of hand-set type. Not only that, these thousands of printers who operate the linotypes receive more than double the wages of the men who stood at the fonts.

SPIRITUAL BENEFITS AS WELL

In this remarkable example of what science does for humanity, but especially for the worker, chemistry plays an important part. As long as paper was made from rags, the cost of paper production would never have permitted the development of these mechanical improvements in printing. Not only would paper have been too scarce, its cost would have been too high. But a Frenchman happened to watch a swarm of hornets chewing the decayed fiber of a log and mixing it with some fluid they secreted in their bodies. With this they built their nest, and the Frenchman discovered that the material used was practically paper. He said to himself, "If hornets can make paper from wood, why can't human beings?" Now, thanks to his experiments, we make from pulp and sulphite unlimited quantities of paper that enables any newspaper to issue thirty-two pages each day of the week and many more on Sundays. As for the other uses of paper made possible by this cheap process, the list is inexhaustible. The whole field of industrial chemistry is covered in what the laboratory has done for the improvement of paper alone. As for what this added to life, the results are beyond calculation. You can not touch our present existence at any point without hitting upon some point where science has revolutionized it. But I think that in giving us cheap books and papers, science has performed her greatest miracle of all. From the primer before the schoolboy's eyes, to the work of science or history or biography that continues his father's schooling to his dying day, printing and paper seem to me

the magic touch of science that has lifted men's eyes from the ground and pointed them to heaven and to God.

Recently the industrial chemist has given us a quick process for the making of silk in the form of rayon, which will soon supplant the slow and limited supply of that important product. The utterly amazing development of the automobile will either give us a substitute for rubber, or it will give us an auto tire that is not from rubber at all.

This seething activity in the field of practical science is not concerned alone with merely bettering our ways of doing the old things, either. It is reaching out to develop new wants and then to supply them. It seems idle to speak of the radio as one of these. The aeroplane is another just as familiar. At present alarm has been created for aviation because of recent deaths and accidents. It must be remembered, however, that this high fatality record is the outgrowth of stunt flying, or the undertaking of hazardous flights poorly prepared for. On the other hand, commercial flying has become so safe that 2,000,000 flying miles are now achieved to each fatal accident. This is almost as safe as railroad travel, and far better than our scandalous accident record from the automobile.

DISTRIBUTION OF EMPLOYMENT THE ONLY TRUE MEASURE OF PROSPERITY

In view of all these things, our whole method of measuring things is being changed. Prosperity used to be measured by the number of things sold. I firmly believe that within ten years we shall accept what is to my mind the only true measure of prosperity—that is, the general distribution of employment. We are trailing along the old lines of economic theory in the matter of production, when the object sought was the production of more and more, and ever more. I believe that within ten years the old-time economists will be obsolete. I believe the real object to be sought in the future is the manufacture of just enough to satisfy the national demand, and the orders that come to us from other lands, and no more.

MAN POWER CONSERVATION THAT IS REAL

Then we shall see at least some real conservation. Economists will then live up to their name. We shall have real economy in the conservation of our national resources, our raw materials, our national energies, and, above all, a saving in our man power. We shall not wear out our workers, but rather lengthen their lives and usefulness, at the same time that we lighten their labors.

Most important of all will be economy of time. With our work done more easily and quickly, we shall have a larger remainder of time

for use in other and better purposes than the feverish production of goods that we cannot sell.

Every ounce of production over our capacity to consume is not only a waste, but it does more harm than good because it disturbs the price and distribution of that which cannot be consumed at a reasonable figure.

So, while science has accomplished wonders for industry that were undreamed of a century ago, I believe the field of its usefulness is barely opened. One opportunity for a new application of science we see all around us. I believe the science of economics and organization must sooner or later reorganize the whole industrial system. Nothing less than that will serve to control and to stop over-development of producing capacity, over-production of commodities, that is, the production of commodities that cannot be consumed at a reasonable price. This must be done in a way to avoid the unemployment of labor or the cheapening of labor. On the contrary, we must recognize our working population as in itself a great market. But in the new industrial system hours will be shortened, wages will be maintained and more broadly distributed, and the leisure that will come, the "time to think," may be used by the vast majority of our workers to obtain better education, high intellectual levels, and a still higher standard of living.

A NEW CONCEPTION OF LIFE

Neither will this new industrial system be a cost to any one of its groups. On the contrary, it will be not only self-sustaining but self-enlarging. The more highly educated our workers, the more they will demand of life. That is, they will demand more commodities to satisfy their needs. The money to meet their wage demands will come of this larger market for goods that they themselves will create. And while this is coming about, I believe we shall arrive at a new conception of life itself. Its great goal will then be happiness, rather than the possession of many things.

It seems to me I see this coming about even now. More and more our industries are paying for brains rather than muscle. Manual skill alone is no longer enough. Brains are more and more demanded, and we are training the brainier worker to supply the demand. It is to be questioned whether automobiles, radio, the motion picture, lectures and night schools would have appealed to the workman of a hundred and fifty years ago. At the end of his long day's work he was too tired to feel any interest in such opportunities and forms of amusement. Science has come to his aid, with lighter work, shorter hours, higher pay, and more "time to think." But the job is not finished, and science will carry us still further.

If a Greek of 2,000 years ago were to return to earth, he would be amazed by these developments of modern practical science. He would marvel at the steam engine and the radio, the telegraph and the telephone, the automobile, the electric light and the enormous wealth our machinery is turning out. But after he had made the round of shop and mine and field, he might inquire whether we had brought our minds and bodies along in pace with our machines. For the people of Greece cared more for a sound mind in a sound body than they did for amassing great wealth. The one thing that might reconcile a returned Greek to much of our modern life would be his discovery that human slavery as he once knew it had come to an end, and that the machine had become the slave.

This is the crowning glory of our modern world, and science has been the giver. Having now freed man from much or most of his ancient labors, the next great work for science is to make of this new freeman with "time to think" a being who is happy, not because of the amazing things he owns, but because of the amazing things he can do and think.

THE WORK OF THE WOMEN'S BUREAU OF THE UNITED STATES DEPARTMENT OF LABOR

Miss Mary Anderson, Director.

All of the work that is done by the Women's Bureau of the United States Department of Labor can be classed under the broad general head of Health. But we are not concerned only with the health of the woman worker. Our interest in her is greater than simply in her potentialities and rights as an individual human being. She interests us chiefly because she is an important part of the nation as a whole, and her development or retardation must therefore have a real influence on the welfare of business, the family, and the nation.

The labor laws enacted in the states throughout the nation for the regulation of hours and wages and conditions of work for women in industry are based on the power of the state to protect health. It is the recognition by the courts of the special significance to general welfare of the health of women, combined with the more serious effect upon women than upon men of long hours, low wages, and unhealthful working conditions, which has resulted in the upholding of laws regulating such conditions. With the legal sanction for such regulation once given, legislation of one sort or another affecting conditions under which women may be employed has been put on the statute books of every state in the Union except Florida. These laws vary in the different states, ranging all the way from a careful regulation of hours and wages and a very definite supervision and control of working conditions in states such as Oregon, California, Massachusetts, and others, to the requirements simply of seats for women workers in certain occupations in Alabama, Florida, and West Virginia.

The fact that there are 48 legislative bodies, with the right to self government in conformity with the Constitution of the United States, explains why there is such great diversity in legislation and little attempt at uniformity. This is particularly true in regard to labor legislation for women workers. Greater uniformity in the matter of standards is essential. In order to bring about such a condition, it is necessary to have facts and figures on these questions which so vitally affect our working women.

The Women's Bureau of the United States Department of Labor was created to work with the state departments to give information of a nation-wide character that would be of benefit to all the states in

their work, and to formulate a set of standards practical for the employment of women in each of the 48 states and to render every possible aid in the establishment and maintenance of such standards.

CONDITIONS OF WOMEN'S WORK INVESTIGATED AND STANDARDS ENUNCIATED

The Women's Bureau is, therefore, primarily a fact-finding organization. We are charged with the duty of investigating the conditions under which women are working. Our function is to enunciate standards for the effective employment of women in industry. It is essential, therefore, that we know the conditions of employment and their effect upon the women in order that the best standards may be inaugurated. In order to collect the necessary information to carry out our program, the Bureau conducts extensive studies of various phases of women's employment. Cooperation in these studies between the Women's Bureau and the state departments has proved of special value and benefit to both. The work done by the federal bureau under these circumstances has been in no way a duplication or usurpation of the work of a state department. The primary function of the state department of labor is law enforcement and this must be its first and most important task. It has rarely the funds, personnel, or equipment for intensive investigations. The Women's Bureau, accordingly, renders a valuable educational service to the state when it makes a survey in the state, collects detailed information on the hours, wages, and working conditions of women workers, and puts such data in available form. On the other hand the state department gives definite assistance to the Women's Bureau in such a survey by giving it an insight into the general industrial and legal situation in the state and in this way facilitating the work of the Bureau. This cooperation is essential.

FUNDAMENTAL STANDARDS NECESSARY TO INSURE HEALTH AND EFFICIENCY

The standards proposed by the Women's Bureau as a result of its knowledge of industrial conditions can only be suggestions as to the best practice for the effective employment of women. The Women's Bureau has no legal authority to enact or to enforce legislation or standards in any state or in any industrial establishment. It can, however, inaugurate investigations, collect facts in any state or industry and make recommendations for improvement of conditions. The standards that we have formulated cover conditions only in a general way, but they are the fundamentals that apply to all industries and all occupations. Qualifications and elaborations may have to be

instituted to meet special cases and peculiar conditions, but the fundamental standards necessary to insure health and efficiency will not be altered. Broadly stated, these standards for women in industry that constitute the program and the creed of the Women's Bureau are:

- The eight-hour day
- Saturday half-holiday
- No night work
- A living wage based on occupation and not on sex, with the minimum rate sufficient to cover the cost of living for dependents and not merely for the individual
- Good working conditions, including—
  - Adequate washing facilities
  - Adequate and sanitary toilet accommodations
  - Dressing rooms, rest rooms, and lunch rooms
  - Clean workrooms with carefully adjusted lighting, ventilation, and heating
  - Plentiful and sanitary drinking facilities
  - Chairs, machines, and work tables adjusted so that the workers can either stand or sit at their work
  - Carefully guarded machinery
  - Elimination of the necessity for constant standing or other posture causing physical strain
  - Avoidance of repeated lifting of heavy weights, or other abnormally fatiguing motions, and the operation of mechanical devices requiring undue strength
  - Avoidance of exposure to excessive cold, or to dust, fumes, or other occupational poisons without adequate safeguards against disease
  - Prohibition of employment of women in occupations involving the use of poisons that are proved to be more injurious to women than to men
  - Prohibition of home work
  - Establishment of systems of employment management
  - Cooperation of workers in establishing standards

In this group of standards there readily are found many recommendations that apply fully as strongly to men as to women. There is no indication, for instance, that bad ventilation in a workshop is a more serious menace to women's health than to men's, nor that it has any distinctive effect upon women. Insufficient ventilation will lower the efficiency and the ability to resist disease of both women and men, and it should be recognized as a problem for all employes in all industries under all conditions. The prevention of glare by properly placing and shading lights is another working condition that is not particularly a woman's problem, but instead is a problem for all in industry. It may be said here, however, that women are usually employed on smaller articles and do more minute inspection work than men, and that light-

ing, therefore, should be one of the special standards to be taken into consideration in women's employment. Considered as a whole, however, very few if any of these recommended standards can be said to apply only to women, and the Women's Bureau does not advocate that they should be so considered. The important thing about them is that they apply *especially* to women. For all conditions in industry bear particularly heavily on women, and therefore good working conditions, hours, and wages have a more important relation to their health.

THE SPECIAL IMPORTANCE TO WOMEN OF AN EIGHT-HOUR DAY AND A LIVING WAGE

Long hours in the factory are not so serious for the man, who is through work when he leaves his job at night, as they are for the woman, who often has several hours of housework to do after she gets home. The married woman in industry, who is forced to work because of economic necessity brought about by her husband's death, incapacity, or inability to earn an adequate wage for himself and his family, must usually take whatever job she can get, without too much question of wages or hours. But she is the one worker in all the group who most needs the protection of the law, for the care of her children and household will take many hours and much strength, and her health will suffer if hours of work are not limited.

Perhaps the two greatest health measures that industry can institute for all workers, but particularly for women who are not organized so that they can make their own demands and who are massed in the low-paid industries, are the eight-hour day and the payment of a living wage. Long hours are especially a hardship for women, but the low wage paid to the average woman worker is an even greater menace to her health. In recent investigations made by the Women's Bureau in fourteen states is disclosed the fact that the median wage ranged from the highest, $16.85 a week, to the lowest, $8.60 a week. When we realize that the median wage means that half of the women received more and half received less, the low wage and the high cost of living should certainly be recognized as a condition that saps the health and vitality of a large group of workers.

THE WOMAN PROVIDER NOT PROPERLY RECOGNIZED

This is particularly true when the woman worker is recognized as a provider not only for herself but frequently for dependents as well. The responsibilities of the wage-earning woman and her contribution to the support of others—mother, father, sisters, brothers, husband, children—have not yet received full recognition from industry or from the general public. Yet in every investigation that we make touching

wage-earning women there piles up the evidence that women are working more often than not to eke out some husband's or father's insufficient wage and to make it adequate for the family needs, or else to earn the wage that had formerly been earned by a husband or father who has died or been incapacitated.

LONG HOURS OF WOMEN WORKERS

Another outstanding fact that has come to light through our investigations is that in practically all the southern states where we have made surveys, the percentage of women working 48 hours or less has been very low, in some of them so low that there is almost no percentage to be recorded. Roughly, the proportion of women who worked 48 hours or less in the nine southern states investigated ranges from 1 per cent in Georgia to 21 per cent in Arkansas. Maryland is the only southern state in which a considerable group of women worked short hours, due to the predominance of the garment workers in that state, who, with a strong union, have run the percentage of women working 48 hours or less up to 52 per cent. In the north, on the other hand, in the states we have surveyed there, the proportion of women who work 48 hours or less ranged from 13 per cent in Indiana to 68 per cent in Rhode Island. The bulk of the women of the northern group really lies between 34 per cent and 68 per cent, with Indiana and Iowa, which have no laws regulating hours, and Oklahoma with a nine-hour law, bringing the record down.

THE EFFECT OF INDUSTRIAL POISONS

Low wages follow long hours. History tells us that when there is a reasonable working day and good working conditions, we find also better wages. In other words, better standards are likely to be found pretty consistently together, while the less acceptable standards follow the same rule. In addition to the general health problems of long hours and low wages for women, there are more specific ones which have to do with concrete health conditions. Chief of the questions of this type is that of the effect on women of certain industrial poisons. The effect of lead poisoning on women is generally known and accepted by most industrial experts since Doctor Hamilton's able study of this matter. A more recent problem along this line has been the effect on women of the fumes of benzol, an agent that is growing in use in modern industry.

In a recent study of this subject made by the Bureau of Women in Industry of the New York State Department of Labor, the conclusions, in part, are:

Benzol as used in the industries investigated produces chronic poisoning in virtually one out of every three women.

The risk of poisoning is not limited to those who work directly with benzol, but workers who are indirectly exposed through merely working in rooms where benzol is used are subject to its effect also.

Among women who do not show definite signs of poisoning, more than one-third suffer from symptoms most of which, in all probability, are caused by exposure to benzol.

Susceptibility to benzol poisoning appears about equally marked among younger and older workers.

WOMEN FEARFULLY WEIGHTED IN THE RACE FOR LIFE

The present day is hearing a great cry for women to be given equal opportunity with men for all occupations in all industry. Even the most ardent of these exponents of the new creed of feminists will pause, however, before a presentation of the case for better protection of working women based on a scientific study of the effect on their health, and on the health of future generations, of exploitation, long hours, low wages, and improper working conditions. The women of today, as well as their employers, "come from Missouri." No sentimental or idealistic appeal will be sufficient for either of them now. They want facts, and if the facts are presented strongly and clearly, they will get action.

But the facts must be collected first, and the field is open and crying for attention from scientists and health experts as well as from industrial engineers. May we say with Huxley, "Women will be found to be fearfully weighted in the race for life. The duty of man is to see that not a grain is piled upon that load beyond what Nature imposes, that injustice is not added to inequality."

THE RURAL HEALTH PROBLEM AND ITS SOLUTION

JOHN A. KINGSBURY, Secretary of the Milbank Memorial Fund.

"No Man's Land," in the battle against ignorance and indifference for better health, lies for the most part in the rural regions of the nation. That is the territory over which the organized army of health crusaders has progressed most slowly. The rural health situation is perhaps the most serious health problem facing this nation today.

The cities, of course, have their health problems, but they recognize them, and try to do something about them. Every city in this country has a health officer. One of the great difficulties about the city health officers, however, is that so many of them are only part-time men. Even the full-time city health officers are in thousands of instances so poorly paid that they must carry a private practice to supplement their incomes. This means that many of these men are handicapped for sufficient time to devote to the study and solution of the public health problems with which their communities are confronted.

As a whole, however, the cities in this country have solved, or are in the process of solving, their problems of sanitation. They have a safe water supply, a fairly adequate system of sewage and garbage disposal, and they protect their milk and food supply against contamination. Most of them have adopted and carry out quarantine laws. Epidemics of contagious diseases occur in cities with less frequency than formerly, and when they do occur the volunteer and official health authorities are usually able to check them speedily. Every city makes some budget provision for public health and most of them have some hospital facilities. Moreover, the pick of our physicians and surgeons, the most highly trained of our practitioners and specialists, are apt to be found in greater numbers in our cities. At least in urban areas there appear to be enough doctors to go around.

HEALTH SERVICE IN RURAL SECTIONS PITIFULLY INADEQUATE

Unquestionably, health conditions in the cities are far better than those to be found in the rural sections of the country, where, with relatively few exceptions, the total health facilities are pitifully inadequate.

This situation appears particularly serious when one considers that sixty per cent of the people of the United States live in the rural regions. That means that seventy million people live in the open country or in rural towns and villages with populations of twenty-five hundred or under. According to Dr. L. L. Lumsden, Surgeon of the

United States Public Health Service, eighty-three per cent of these seventy million people are without reasonably adequate local health service![1]

All of the state governments have departments of public health that provide a certain degree of health protection to the most accessible rural sections, but although most of the state public health services realize the immensity of the rural health problem, few of them have appropriations from the legislature adequate to enable them to cope with the situation. This means many times that it is easiest for the state public health services to help those counties that help themselves—in other words, counties in which the county supervisors have been persuaded or stimulated to appropriate a sufficient budget to initiate a county public health program under trained leadership.

Eighty-three per cent of our rural population, representing fifty-eight millions of people, are dependent for community public health protection upon poorly paid, part-time county health officers, many of whom have had no public health training and some of whom lack even an understanding of the rudiments of public health work. The majority of the rural county health officer positions open to doctors of public health carry with them such inadequate salaries and so little prospect of promotion that few really good men are attracted to them. Even if one of the best doctors in a community can be persuaded to become the county or village public health officer, he is almost sure to be too busy in his private practice to make the general public health of his community his first concern. In rural sections there are fewer volunteer health organizations, fewer hospitals, fewer clinics. In some rural counties there are no hospitals and no clinics. The best of the physicians and surgeons, graduates from modern medical colleges, as I have said before, are not attracted in large numbers to the rural sections. The good old conscientious country doctor who has worried very little about the collection of his bills will soon have passed away. Frequently comes the cry from inaccessible regions that there is sickness and no doctor within a radius of many, many miles to minister to those who are ill.

We are told by Dr. Lumsden, in one of the recent weekly reports of the United States Public Health Service in an article discussing the rural health situation, that at least a million people living in rural communities are incapacitated by illness all the time. Thirty per cent of the men of military age are rendered unfit for arduous productive labor from causes that could have been prevented. More than sixty per cent

[1]Report of the United States Public Health Service on "Cooperative Rural Health Work of the Public Health Service in the Fiscal Year 1927," by L. L. Lumsden, Surgeon. Public Health Reports, Vol. 42, No. 42, p. 2549, October 21, 1927.

of the men and women of the rural districts between forty and sixty years of age are in serious need of physical reparation, for the most part as a result of neglect. More startling still perhaps, seventy per cent of the rural school children have physical defects that are for the most part remedial or preventable.

A BOY DYING FROM LACK OF FACILITIES

On a recent trip into a Southern rural county with Dr. Stephen A. Douglass, formerly County Health Officer of Cattaraugus County, New York, I met one of these neglected school children. Curiosity about the conditions under which an entire family must live in a small one-room shanty led me to suggest to the public health nurse, who was showing Dr. Douglass and me some of the demonstration health work recently begun in this county, that we visit a few of these shanties. We visited two of them and one I shall never forget. It was a one-room home, typical of the kind lived in by the poorest of the Southern Whites. It was heated by an open fireplace. Its walls were lined with pink building paper. There were four beds in the room. The day's washing hung in front of the fire. The occupants were a man and his wife, both chewing tobacco and spitting into the fireplace, and four children ranging in ages from five to thirteen.

Seated on a chair in front of the fire with coat and cap on, leaning down and supporting himself by a pillow in his lap was a thirteen-year-old boy. Death stared at us from his hollow eyes. Dr. Douglass immediately asked a few questions and the mother began to raise the boy's coat and shirt and to pull off dirty cloth bandages soaked with pus. The boy had what Dr. Douglass called tuberculous osteomyelitis, affecting third, fourth and fifth lumbar vertebrae from which there was a large discharging ulcer. In addition to that, he had a large superficial ulcer under the left flank discharging freely, together with bilateral psoas abscesses discharging on either side of the groin. The Doctor tested his lungs and found a dull right apex so marked that I could hear it myself. I have never seen a more pitiful sight, nor a more unfortunate family. This poor little kid the Doctor thought could be cured by heliotherapy, proper casting and care, but with a good deal of deformity. For lack of facilities, however, he will die within a year.

CONTRASTS IN URBAN AND RURAL DEATH RATES

Rural mortality rates also contrast unfavorably with those of urban areas. Dr. Henry F. Vaughan, Health Commissioner of Detroit, Michigan, has already spoken of this. I would like to add three more striking examples from New York State to those that he has given. In 1900 the urban death rate from all causes in New York State was 19 per thousand; last year it was about 12 per thousand. During that

period the rural death rate has remained about stationary—that is, about 16 per thousand.

The death rate from tuberculosis in New York State presents a similar picture. The urban death rate in 1900 from tuberculosis was 250 per hundred thousand. The rural death rate was 150. The last year for which I have the figures (1923), the urban tuberculosis death rate had dropped to 92, in contrast to a rural death rate of 120.

Although the death rate from typhoid has shown a dramatic drop, both in urban and rural communities throughout the country, again the cities have gained most through the application of modern scientific knowledge. In 1900 the rural death rate in New York State from typhoid was 32 per thousand, in contrast with an urban death rate of 25. In 1923 the urban typhoid death rate was 2.5 against a rural rate of 3.4.

These figures confirm Dr. Vaughan's statement that during the past twenty-five years great strides have been made in the improvement of the health conditions in most of our large cities, while in the rural communities there has been comparative neglect of the health of the people.

THE ECONOMIC BURDEN ON THE RURAL COMMUNITY

There is another side to the rural health problem that I have not touched upon. The cost of illness and the economic losses due to it are tremendous, but I have not time to go into that phase of the problem. I merely remind you that Dr. Charles Holmes Herty, Advisor to the Chemical Foundation, Incorporated, has told us that fifteen billion dollars is the modest bill of the nation for sickness, much of it preventable. Or, if you choose, you may take the more conservative figure of Dr. Louis I. Dublin, Statistician of the Metropolitan Life Insurance Company—six billion dollars! More than half of the six billion, or at least three billion dollars, is the loss borne by the rural population.

THE PITFALLS OF PREJUDICE

This is but a thumb-nail sketch of our rural health problem! I have not shown you the barbed-wire entanglements of ignorance and indifference in the "No Man's Land of Health." I have not pointed out the pitfalls of prejudice, nor the slime of selfishness, that are there; for after all, ignorance and indifference and prejudice and selfishness are to be found everywhere. It is disappointing, though, when one finds these weaknesses prominent in the medical profession. I fear they are more common in the country than in the city. However, we must leave these little doctors, who dig pitfalls, to the big doctors who will

push them in and bury them. Over their graves let us erect a slab and inscribe upon it this epitaph:

"He digged a pit, he digged it deep,
He digged it for his brother;
But for his sin he was pushed in
The pit he digged for t'other."

WELL-TRAINED PHYSICIANS NEEDED AS LEADERS

Perhaps the most important step in the solution of the health problem everywhere is to get the well-trained physician to take an active part in public health work. Let us get the big unselfish medical men to assume the leadership that belongs to them. Let us not leave the public health to the mercy of petty political doctors. The rural health problem is the challenging problem of this country today and of every other nation. We must have able leaders, physicians and laymen to solve it. We need our best men for it, and some of our best men are beginning to answer the call of the rural regions.

SANITARY ORGANIZATION NEEDED

Theoretically the solution to the problem is simple enough. The answer is—*effective organization*. That was the key, says Osler in his "History of Modern Medicine," to the solution of the most serious and baffling rural health problem the world has ever known, the problem in Panama. A death rate of 170 per thousand prevailed there when the French were attempting to build the canal. Within a year after the sanitary organization under the leadership of General Gorgas was effected, the death rate among Whites had dropped to 8 per thousand and among the Blacks to 40 per thousand. Panama, known for a century as "The White Man's Grave," has become a tropical health resort. "What was done there can be done elsewhere," Osler declares.

Effective organization requires, however, intelligent and energetic leadership. Such leadership requires adequate funds. Adequate funds depend upon the cultivation of public opinion. That means education, and education in turn calls for funds. In Panama there were all the elements of effective organization when America decided to build the canal. Inspired by a powerful and courageous President, public opinion supported Congress in providing adequate funds—and Gorgas did the rest. Panama is not a typical situation, but it points the way. It indicates what could be done to solve the rural health problem of over fifty million people should we some day elect a President of vision, power and drive, who could see the health problem of the rural sections as President Roosevelt saw the problem of the Panama Canal.

THE COUNTY THE MOST PRACTICAL UNIT FOR RURAL HEALTH SERVICE

I said that the solution of the rural health problem is theoretically simple. There must, of course, be units of population and taxable property extensive enough to support effective health service, but not too large for effective organization and administration. It seems to be quite generally agreed that the county is the most practical unit for rural health service. Where the counties are too large for effective administration, however, a group of adjacent townships might be organized as a unit for health service. If, on the other hand, counties are too small to support adequate health service, a health unit consisting of two or more adjacent counties might be created. It is my opinion that population units of less than fifty thousand cannot, or will not, support a modern, effectively-organized public health service. Units of one hundred thousand would, I believe, be better. This would depend, however, upon various factors, such as the wealth of the community, topography of the country, the condition of the roads, the density of the population.

Yes, the rural health problem may be solved if given certain factors —a population unit economically self-sufficient, an educated public opinion conscious of the problem, a trained, tactful, efficient full-time county health officer, and the assured cooperation of local physicians. These "ifs" are all big ones, I grant you—and the last one perhaps the biggest of all.

THE DUTIES OF A FULL-TIME COUNTY HEALTH OFFICER

Such a county public health officer as I have in mind will establish, or make easy contact with, a diagnostic laboratory. He will provide for sanitary inspection. He will organize a rural nursing service. He will develop communicable disease, tuberculosis, venereal disease, maternity, infancy and child hygiene services, and such other services as local conditions dictate in the light of modern scientific knowledge and good administrative practice. He will foster medical examination of school children and the prompt correction of detected physical, mental and moral defects. It goes without saying that if adequate and satisfactory hospital, sanatorium and clinical facilities are not available, the health officer will feel the responsibility to see that such facilities are adequate and satisfactory.

This county public health officer will not, of course, do all of these things at once but he will do them as rapidly as public opinion, financial support and effective organization will permit. It will, however, be necessary for such a county public health officer to cultivate public opinion and not to wait for public opinion to annihilate him. Obviously, he should take frequent counsel with the medical profession and with volunteer health agencies, and encourage them to participate in the gen-

eral community health program. His leadership should be felt both within and without the medical profession. He should be a man of conviction and of courage, not one who truckles to quacks or fanatics or to petty politicians, medical or otherwise, who, in order to further their own selfish ends, seek to impede the progress of the development of an adequate program of public health. Such a man could win the support of the strongest men in the medical profession and the leading laymen of the community.

THE POSSIBLE PROFIT IN MONEY AND LIVES

The rural health problem must be solved. Dr. Lumsden estimates that an annual national expenditure of twenty million dollars would insure reasonably adequate whole-time rural health service throughout this country[2]. Aside from the factor of human suffering, consider Dr. Lumsden's plea for twenty million dollars for public health service as contrasted with Dr. Dublin's estimate of a national annual loss from sickness, much of which is preventable, of six billion dollars, over three billion dollars of which is lost in the rural regions. The rural health problem is slowly being solved under the leadership of the United States Public Health Service and the progressive state health officers of the country in cooperation with national, state and local voluntary health agencies and the foundations interested in the promotion of public health, but the fact remains that at this present time 83 per cent of our rural population is without adequate public health protection.

[2]Report of the United States Public Health Service on Extent of Rural Health Service in the United States, 1923-1927, Public Health Reports, Vol. 42, No. 17, pp. 1173-1174, April 29, 1927.

A PUBLIC HEALTH DEMONSTRATION IN MONTREAL, CANADA

EDITH B. HURLEY, M.A., R.N., Professor of Public Health Nursing, Université de Montréal

Less than three years ago, on the twenty-sixth of March, 1925, to be precise, the inauguration took place in Montreal of the French Health Centre, which was to serve as a health demonstration unit and as the laboratory for the School of Public Health Nursing of the Université de Montréal to be opened the following September. Leading health and social workers of the city, representing both the English and French Canadians, attended in large numbers to show their interest in this first step towards a constructive health program in the poorest section of Montreal where the need for health work was greatest.

The Centre and School, under the same management, are financed by four organizations cooperating with the Université de Montréal. These four organizations, namely, the Metropolitan Life Insurance Company, the Montreal Anti-Tuberculosis and General Health League, the City Health Department and the Provincial Health Department, were all represented at the inauguration by speakers who stressed the great need of a health demonstration in this strictly French-speaking section of Montreal. There was such a field of activity exposed it seemed inevitable that some harvest would be reaped once the seed of scientific knowledge was scattered. When we, who were to be responsible for the execution of the work, heard such an eminent authority as Dr. Lee K. Frankel prophesy that the Health Centre and School would be a means of providing longer, healthier and consequently happier lives for the French Canadians, while another speaker said it was a venture to save lives in the Province of Quebec, and still another that it would be the means of keeping well people well, we were rather appalled at the enormousness of the task and the results expected of us. The questions where and how best to begin to get results were uppermost in our minds.

SETTING OUT TO PROVE TO MOTHERS THAT INFANT DEATHS ARE NOT ALWAYS UNAVOIDABLE

The salient point of attack in order to prove in the shortest possible time that lives *can* be saved is infant mortality. So it was decided to begin with that problem. In the particular section of the city chosen for the demonstration area, comprising two parishes with a population of 22,000 persons, the infant mortality had reached the rate of 220 per 1,000 just previous to the opening of the Health Centre. So-

called infant welfare work had been going on for a period of ten years in this district, but with practically negligible results, due to the fact that the only workers were well-intentioned but untrained lay women who did not even understand the necessity of undressing a baby to weigh it properly and who were unqualified to note those defects that would call for immediate medical attention.

A study was made of the parish records to ascertain just how many babies had been born in the district in the past ten years, how many had died, and what had been the causes of death. In the French-speaking sections of Montreal, which are entirely Catholic, it is customary for every baby to be baptized and enrolled in the parish register within two or three days after birth, and no burial certificate is issued without note being made of the age of the deceased and the cause of death. Through the courtesy and cooperation of the parish priests, these records were made immediately accessible to us. A study of them revealed that we were confronted with an infant mortality rate of 220 per 1,000, the predominating cause for which was gastro-enteritis.

The gastro-enteritis, in turn, we found was largely attributable to the fact that the babies were for the most part bottle-fed, being weaned in many instances during the first few weeks or even days after birth. Here then was our first problem—to save by constant health supervision the babies already born and to prepare the way for better babies by carrying on a campaign of education with the mothers.

We knew what we had to do and how to do it, but putting our good intentions, plans and knowledge into execution was not so easy. We set out with a house to house canvass, knocking at every door in our demonstration area, to ask if there were any babies and pre-school age children in the family and, if so, to talk with the mothers and invite them to bring the children to the Health Centre.

We were told by many of the mothers that they knew more about babies than we did, having brought into the world any number from six to twenty. One mother told us that she had given birth to seventeen children and needed no advice from us. We gently asked, "And how many are living now?" We were answered, "Seven are left, but ten little angels in heaven make a nice crown of stars for a mother." On inquiring further into the cause of the infant deaths, we learned from the mother that Marcel, Pierre, Rose-Marie, and Jean-Paul all died in the summer because the "dog days," as she said, were so hard on babies, and the babies had all been weaned early because just as soon as the mother got up out of bed her "milk wasn't good any more." In a word, they looked upon infant deaths as natural and

unavoidable, which point of view is quite characteristic of any part of the world where poverty, ignorance and unemployment exist.

The nurses did succeed, however, in being admitted to the homes, and with the tact, courtesy and gentleness for which the educated French-Canadians are renowned, persuaded the mothers to come to our Health Centre. Once there we took every precaution to give them all possible privacy during the undressing, weighing and examining of the children, and the same consideration of their feelings prevailed during the consultation with the doctor.

THE PERCENTAGE OF DEATHS DECREASED AS THE PERCENTAGE OF BABIES FED AT THE BREAST INCREASED

We never let slip an opportunity to stress the importance of breast-feeding, even speaking of it from the economical point of view when nothing else seemed impressive. To satisfy mothers who were convinced that their milk "was not good," as they said, we expressed a small amount, which we sent to the Provincial Laboratory for analysis, later explaining the report to the mother. In nearly every case, as you may surmise, the milk was normal, and when not entirely up to par, it was merely fat deficiency. With a laboratory report before us to convince the mother that her milk *was* good, we concentrated even more on the importance of breast-feeding.

We made a chart to show the percentage of our babies who were bottle-fed when we began our demonstration. We found that 45 per cent were bottle-fed, leaving only 55 per cent fed at the breast. It is interesting to watch this chart now from month to month and to see how the breast-fed babies are increasing and, consequently, how the deaths from gastro-enteritis are diminishing and our infant mortality rate improving. In less than three years, or in exactly two years and nine months (about half the time allotted for our five-year demonstration period), we have reduced the infant mortality from 220, with which we began, to 96.7 at the end of 1927.

We still have far to go to attain the rates prevailing in most American cities, but we are working, and we are hoping that by the end of our five-year demonstration period we shall be somewhere in the seventies.

NEW-BORNS ARE PREMUNIZED AGAINST TUBERCULOSIS

Our baby welfare work now is such as you will find in any well-organized American health center, but in one respect we are unique, as we were the first organization on the Western Hemisphere to use the Calmette vaccine to "premunize" the new-born against tuberculosis.

We administered the first dose on the twenty-third of June, 1926. Until a few months ago we were the *only* organization in America using this vaccine, but we understand that Dr. William H. Park of New York City has now under his observation a group of about thirty babies to whom he has administered the vaccine. We had a call last month from one of Dr. Park's staff who came to study our method of giving the vaccine and the results thus far observed. Last May we were honored by a visit from Sir George Newman, Chief Medical Officer of the Ministry of Health, England, and in describing our work we mentioned that we were giving Calmette's vaccine to protect our new-born babies against tuberculosis. Sir George stopped us at once and said: "Now that is interesting—that's what I want to know about." So perhaps I will be pardoned for going into some detail in this paper regarding this new activity for Race Betterment, on the assumption that you, too, will be interested in the introduction and use of the Calmette vaccine on this continent.

HISTORY OF THE USE OF B. C. G. VACCINE

The steps leading up to the actual administration of the Bacillus Calmette Guerin vaccine, or B. C. G. as it is commonly called, are rather interesting. At the October, 1925, meeting in Ottawa of the Associate Committee on Tuberculosis of the National Research Council, Dr. Baudouin, representing the Université de Montréal, stated that the university was prepared to bring a delegate from the Pasteur Institute, Paris, to direct the research on tuberculosis. In April, 1926, Dr. A. Pettit, an associate of Dr. Calmette, arrived in Montreal, and it was decided to prepare the B. C. G. vaccine as the contribution of the Université de Montréal to the National Research program. Under the scientific direction of Professor Pettit, the vaccine was prepared and made ready for distribution.

For its actual administration, the French Health Centre's demonstration area was used. In this area, through the home visiting and clinic work of the students in the public health nursing course, the university is in constant contact with a population of 22,000 persons. The total number of births registered for this area in 1926 was 628 and in 1927 was 618. As we are in a position to make immediate contact with every new-born baby either through knowledge of its mother from attendance at our Prenatal Clinic or through the weekly registration of births at the office of the Parish Priest, every facility was afforded us to administer the vaccine. Before doing so, however, we took the precaution of having the written permission of the family physician and of the parents.

TECHNIQUE OF THE VACCINE ADMINISTRATION

The technique followed was given us by Professor A. Pettit, after the recommendations of Professor Calmette himself, and is as follows: "The vaccine must be administered as soon as possible after its preparation (2-3 days). Three doses are necessary for the premunition. They are given on alternate days in the same week as, for example, Monday, Wednesday and Friday. The first dose is given on the third day after birth when the mother's milk is usually established, the second dose on the fifth day after birth and the third dose on the seventh day. Each dose is mixed with milk, preferably that expressed from the mother's breast, but the milk in any case should be 37 degrees centigrade." The baby swallows the dose mixed with the mother's milk, both making up a teaspoonful. We have not had the least difficulty in persuading any baby to swallow the entire contents of the spoon, as the attenuated tuberculosis germs are mixed with glycerine which makes a sweet concoction very much to the baby's taste. The vaccine is put up in ampules, each ampule, representing a dose, containing one centigramme of B. C. G. in two cubic centimetres of conserving liquid. The first dose should be given one-half hour before the feeding, the other two doses one hour before the morning meal.

We had no difficulty in finding a baby to whom to give the very first dose, as we had a very grateful family in our area. We had rendered signal service to them, having nursed the father through a severe illness, taken care of the mother after the birth of her baby, and had the other two children immunized against diphtheria. We explained to the family that we were about to embark on a new health activity, but the family had sufficient confidence in us to let us give this very new preventive to their new-born baby. So on June 23rd, 1926, Alexandre Trepanier, aged 3 days, had the honor of being the recipient of the first dose of B. C. G. administered on this continent, and thereby became a real pioneer along the lines of preventive medicine.

SUBSEQUENT HISTORY OF PREMUNIZED BABIES

We have followed our premunized babies very carefully, as you may imagine. We have not noted any reaction beyond an occasional green stool after the first dose. Some rather amusing things have occurred in connection with the administration of the B. C. G. vaccine. One mother asked us if it were given to make her baby sleep better. Another, whose baby broke out last summer with heat rash, which cleared up about the time the third dose was given, attributed the improvement in the baby's skin to the vaccine. Although this vaccine is so new, we have not had any great difficulty in persuading our families to have it administered. Perhaps this is due to the fact that in nearly

every family in our demonstration area there has been some history of tuberculosis. Anything that will prevent this well-known and dreaded disease is welcome.

Since June 23, 1926, or in a year and a half, we have given the B. C. G. vaccine to 360 babies. These "premunized" babies (to use Dr. Calmette's own word) have been followed as closely as possible, but we are confronted with the problem of a floating population in our demonstration area and lose more than one-quarter of our families every year through moving. It must be borne in mind that we are dealing with the poorest section of Montreal and that, in spite of all our efforts, when the moving seasons set in, May and October, we lose some of our babies through the parents moving out in the night and not leaving any trace. Of the 360 babies premunized to date, we know, however, that 290 are in good health; 61 have moved and are lost to us; 5 babies were reported sick (cases not connected with tuberculosis) and 4 babies are dead, though none from tuberculosis. Of the total number of premunized babies, 5 are in contact with an active case of tuberculosis in the home and they are all well at the present time.

We have already begun the re-vaccination of some of these babies, as recommended at the expiration of a year from the first dose. Our ambition is to keep as many as possible of these babies under observation to ascertain the certainty, extent and duration of immunity. We desire also to extend this service as widely as possible, and to make it available in Montreal to the practising physicians generally.

Our nurses now have 100 per cent of the babies in our demonstration area under observation, and we have for the entire demonstration area 80 per cent of the prenatal cases, which Sir George Newman said in his opinion is a world record. So you see how it is possible, with such intensive home visiting, for the nurses to find so easily candidates for the vaccine. Three visits are necessary in the course of the week to each new-born baby, but as we also carry on a visiting nurse service with bedside care, it is thus possible to render this additional service along the lines of preventive medicine.

JUSTIFICATION OF THE USE OF B. C. G.

We realize that we are doing pioneer work in this respect and we have as yet no conclusive data testifying to results. But Calmette himself has been engaged in this campaign since July, 1921, and already studies have been made in France concerning the comparative mortality from tuberculosis of vaccinated and non-vaccinated babies that seem more than to justify the use of B. C. G. We are proceeding in Montreal on the principle that we are following the lead of Calmette him-

self—a most conservative scientist. French Canadians are, too, ever ready to welcome discoveries emanating from the Pasteur Institute.

To those in the audience particularly interested in securing more data on this subject than I have been able to give, may I suggest the study of Calmette's recently published book entitled, "La Vaccination Préventive contre La Tuberculose par le B. C. G."

In mentioning the B. C. G. to one of the distinguished members of this Conference, I asked him if he could inform me why it had not yet been adopted in the United States. He answered that it was probably due to the fact that up to the present time the whole anti-tuberculosis campaign in this country had been directed along the lines of health teaching and general hygiene rather than with the thought of the actual administration of a *possible* preventive. We are using the B. C. G. in our demonstration area, not only in the hope that in the future it will be a means of eradicating tuberculosis, but also that it will prove a present help in reducing our infant mortality.

ANATOXINE RAMON USED AGAINST DIPHTHERIA

We not only immunize against tuberculosis in our demonstration area but we also carry on the immunization against diphtheria of preschool age children. For this purpose we use the anatoxine Ramon rather than the better known and more generally used, on this continent, toxin antitoxin. The anatoxine Ramon is produced by the Connaught Laboratories of the University of Toronto, and is furnished to us by one of our cooperating agencies, the Montreal Anti-Tuberculosis and General Health League. Dr. Ramon, Director of the Antitoxin Laboratories of the Pasteur Institute, discovered in 1924 the diphtheria and tetanus anatoxines—a discovery that some authorities consider equal in value and importance to that of the antitoxins for diphtheria and tetanus.

The mission and the rôle of the Ramon anatoxine have been to transform at will poisons as injurious as the diphtheria or tetanus toxins into inoffensive products endowed with immunizing properties and capable of being employed in the preventive therapy of certain illnesses of man or animals. Dr. Ramon came to discover his famous anatoxins by the observation of a fact—unimportant to the lay person, but enough to enthuse a man guided by science and by the wish to help humanity—that the toxicity of the diphtheria toxin was weakened by the addition of a solution of formalin in the proportion of 2 per 1,000. Ramon deducted from this that the weakening of the microbic poison would increase in direct ratio with the quantity of formalin added, the temperature of the medium in which one placed the toxin being raised to 40 degrees centigrade. Thus he obtained in thirty days, by the

addition of a solution of formalin of 3 or 4 per 1,000, non-toxic products but with antigenic powers retained and so able to immunize animals such as rabbits for laboratory purposes, an immunity that permitted him to inject up to 100 times the fatal dose without fatal consequences for the animal inoculated. He continued to observe the anatoxine, and discovered in it very definite characteristics. This product preserves its immunizing properties for a year and, heated to 70 degrees centigrade, it continues to be efficacious. These two qualities give still greater practical value to the discovery of Professor Ramon from the point of view of preservation and of therapeutic efficacy.

Three doses are given, the first being ½ c. c. After 15 days or two weeks, a second dose of 1 c. c. is given, and it is recommended that a third injection be made, 15 to 20 days after the second, of 1½ c. c. to obtain certainly a percentage of 98 to 100 per cent immunity.

The two forms of immunization referred to, i. e., the B. C. G. and the anatoxine Ramon, are new ventures, but we hope results eventually will justify their usage. In a letter just received from Dr. George E. Vincent, commenting on the writer's article in the November issue of the *Public Health Journal,* he says: "You have certainly shown enterprise and the pioneering spirit, especially in your immunizing campaign."

WHAT WAS REVEALED BY A SICKNESS SURVEY

Just a year ago, after we had completed about twenty months work, it was thought advisable to see just what was the health situation in our area, and our good friend, Dr. Lee K. Frankel, suggested that we make a sickness survey, to check up on what had been done and to see what remained to do. The help and guidance of the Metropolitan Life Insurance Company was offered us in making the survey and Dr. Frankel stated that the results would later be analyzed and tabulated by himself and Dr. Louis I. Dublin, statistician of the Company. As the data have now been published by the Metropolitan Life Insurance Company and are available to all those interested in a similar census for the good of their community, it may suffice for the purposes of this paper to quote merely the summary. I should add that the Company also offers technical assistance to any community wishing to make a sickness survey. The work involved was more than compensated for in Montreal by the increased efficiency of our services and in knowing where best to concentrate our future efforts.

The following are the principal items in the sickness survey of the two Montreal parishes in the demonstration area:

1. More than two and a half per cent of the people were found to be so sick as to be incapacitated for work.

2. Each male person in the population lost, on the average, 8.9 days per year, and each female 10.1 days, on account of disability. The amount of time lost was highest in the older ages.

3. The chief causes of disabling sickness were the respiratory diseases and influenza, heart disease, cerebral hemorrhage, rheumatism, tuberculosis and external violence. In view of the recent epidemic conditions of typhoid fever in the City of Montreal, it is interesting to note that at the time of the survey not a single case of typhoid fever was discovered.

4. A considerable number of the sick had been disabled for long periods, nearly half reported having been ill one year or longer. Those sick less than a month constituted about 26 per cent of the total.

5. It was found that 9.5 per cent of all the disabled sick were confined to hospitals, 24 per cent were in bed at home, and the remainder, 66.5 per cent, were at home but up and about.

6. Of those at home but unable to work on the day of the census, 18 per cent stated that they obtained medical attention at a dispensary or at an out-patient department of some hospital. This average is very high when compared with other cities where similar studies have been conducted. The facilities for dispensary treatment in this area of Montreal evidently are very satisfactory.

7. In the ages below 15 years, the preponderant diseases were scarlet fever, whooping cough and diphtheria, and also pneumonia and the other respiratory diseases. In the next age period, 15 to 34 years, influenza, tuberculosis, appendicitis and anemia were reported in largest numbers, and among females, conditions associated with child-bearing. In middle life, that is between 35 and 54, diseases of the digestive system and diabetes were most important. External violence also was prominent in this age-period and the so-called "degenerative diseases" assumed some importance. In the older ages, 55 years and over, the important conditions that caused disability were rheumatism, heart disease, kidney disease, accidents and respiratory diseases.

8. The services of a physician were employed in 76 per cent of the cases. Every case of scarlet fever, cancer, appendicitis, and child-birth had a physician in attendance. Those diseases that showed the lowest proportion under medical care were colds, certain diseases of the nervous system and influenza.

9. Visiting nurses attended 20 per cent of those disabled who were under the care of private physicians, indicating that this population is better off with respect to visiting nurse service than that in the average American community.

10. Already this survey has borne fruit. In the first three months of 1927, the attendance at the clinics of the Health Centre numbered 1,546, as compared with 1,346 in the same period of 1926, that is an increase of 15 per cent.

We feel that our demonstration has thus far proved a success in gaining the cooperation of that section of the population of Montreal that we serve in trying to make their lives longer, healthier and consequently happier. Montreal is a fine city in which to live and work, and, aside from the recent typhoid-fever epidemic, it may be considered as free from disease as any large city can be kept with only 40 cents per capita allotted to the health department. In view of the meagre amount allowed for health work by the municipal authorities, it seems marvelous that the city health officer, Dr. Boucher, can accomplish what he does.

In the Province of Quebec the county unit is being developed, due to the zeal of our Provincial Secretary, the Honorable Athanese David, who is virtually the Minister of Health for the Province. There is no new development along the lines of Public Health and Race Betterment in which he does not take a keen interest. With such a man at the head of the Provincial Health Department, we hope for better days not only in Montreal but throughout the entire Province.

THE ROLE OF THE STATE IN THE REDUCTION OF DEGENERATIVE DISEASES

Guy L. Kiefer, M.D., D.P.H., Commissioner of Health, State of Michigan, Special Representative of Governor Green

The lengthening of the life span that has occurred on the North American continent in the past fifty years is shown by statistical analysis. That this lengthening of the life span has not covered all parts of the world is likewise to be seen from similar figures on the subject from other countries. This conservation of human life is for the purpose of lengthening the span of the working years so that each human unit may produce more during his lifetime. If these added years were not productive years, little would be gained in human happiness.

For the past twenty-five years, effort has been directed and greatest gains have been made in the conservation of child life. There are several reasons for this: First, physiologically, the child is a more delicate organism and responds more readily to changes in its environment or habits than those in a higher age group; second, financially, it is possible to save more child life per dollar of appropriation than in the higher age groups; third, emotionally, it is easier to obtain money from appropriating bodies and the interest of important and influential citizens in a campaign for saving child life than for older individuals. No human would decry the importance of the work of life-saving among children. But we must face another set of facts that cry out for our attention.

It is perfectly obvious to those of us who will take the time to investigate that while the death rate from each of the scourges of child life is falling annually, the death rate from the diseases that play greatest havoc during the working span of life has been increasing. Smallpox, cholera, typhoid and other diseases, which fifty years ago headed the list of important causes of death, have fallen to places of less importance; and the degenerative diseases, which strike down the individual at the time of his life when he is economically most valuable, have taken their places. The death rate from diseases of the heart, kidneys and circulatory system have been mounting steadily during the years that life-saving programs have been carried out and as a result of which more people have been carried into their adult years.

What, then, are we to do for these individuals who have been guided through the shoals of the diseases of infancy and early adulthood and have now reached the age of productivity? The economic value of these lives is far greater than at any other time in their careers. The

investment in their education and training is one that cannot be looked upon lightly. They are entitled to research in the elements of life saving as the more economically important function of our population.

WHY NOT DO FOR ADULTS WHAT WE DO FOR CHILDREN?

It is the plain duty of life extension workers, both in official and private organizations, to labor systematically for the purpose of not only preventing disease and prolonging life among the adult population, but of promoting the health of this age group to such an extent that they will be happier and more efficient during the additional years allotted them. Why should not public health agencies adopt for adults similar methods to those previously used so successfully in saving child life and prolonging the same?

In this other work, educational campaigns started with the mother before the birth of the child — prenatal work — were continued through infancy and childhood, both before and after the school years. The prevention of acute contagious disease and the correction of physical defects were brought about through the establishment of a system of inspection of school children inaugurated back in 1894 by Dr. S. H. Durgin of Boston, and known the country over as "Medical Inspection of Schools." The system really has to do with the inspection of school children. By the discovery of otherwise undetected cases of contagious disease, great good was accomplished in the prevention of the spread of these diseases. At the same time parents were informed of the existence of physical defects in their children, and they were advised whenever the defects were correctible or removable to have them given attention by properly trained medical and surgical men. The point is that the children were looked for and found in their workshop—the school. Why not, as I have said, pursue the same tactics with adults and look for them in their workshops, the various industries, in order to caution them and show them how to correct the faulty conditions and keep well?

BUREAUS OF INDUSTRIAL HYGIENE NEEDED IN STATE HEALTH DEPARTMENTS

Am I advocating that the state shall step into factories, stores and offices and make physical examinations of all employes for the purpose of keeping them well? Not exactly that, and in fact it is not necessary nor is it, in my opinion, the duty of the state, through its health departments, to perform exactly that function. It is, however, a public duty to educate employers of labor of all kinds to a realization of the fact that good health in their employes means greater efficiency and better production, to say nothing of a feeling of happiness and contentment

that makes for a better morale. A healthy worker is a happy and contented worker, and such workers are a strong element in the uplift of our entire industrial and consequently social fabric.

It is true that the management of certain industries have seen the light, have hearkened to the cry of periodical physical examinations and have introduced them in some ways into their fields of labor, but this beginning is only a beginning and should be followed up. Each well organized health department should have in its scheme of organization a "Bureau of Industrial Hygiene," which should work with the industries to the end that there should be established in each of these a competent, well-equipped health department—or medical department if that name is preferred—the object of which should be not to dispense pills and wrap fingers but rather to make frequent examinations and give advice as to the correction of any existing physical defects and to instruct the employes in the science of how to keep well. Personal hygiene should be instilled into them to such an extent that health habits become real habits with the inevitable result of improved health.

Annual physical examinations have been indulged in by certain well-paid executives who appreciate the importance of an inventory of their most valuable stock in trade—their health. With the beginnings of physical inspection of school children, an organization for the annual examination of this group was inaugurated that still has great possibilities. The great life insurance companies have seen the economic value of annual physical examinations and have supplied this service to hundreds of thousands of their policyholders. One life insurance company has found that it can keep the death rate of its policyholders lower by utilizing the physicians' services in annual physical examinations of the persons insured with them than by utilizing their services for the examinations to become policyholders.

CONSERVATION OF HUMAN LIFE PAYS BIG DIVIDENDS

Many of the great industries and employers of labor are realizing that the annual physical examination of their employes is not a hygienic fad but an important service to their employes and stockholders. They are finding that the conservation of the human elements of their business pays bigger dividends than the conservation of mechanical equipment.

From the time a girl applies for a position as an operator of the Michigan Bell Telephone Company until she draws her first pay check as a trained employee, this company spends slightly more than $600 on her training. It would be considered the height of folly if the mechanical department should buy a delicate piece of electrical apparatus for

$600 and then give it little inspection service or care. An intelligent self-interest would dictate that the medical department of the company protect this six hundred dollar investment in the training of an operator with care equal to that of a similar sum in mechanical and electric equipment. The Michigan Bell Telephone Company has in operation, therefore, a well-equipped Medical Department in which preventive medicine is being practised. Not only do they make entrance examinations of all applicants for employment, but all employes are frequently examined and advised. During the past two years, each fall the pollen treatment for hay-fever has been offered free to employes in the Detroit District. The last year's results show that of 39 employes treated, 37 or 94.9 per cent showed improvement and only 5.1 per cent were not improved. Certainly such a showing is well worth the effort that was made, to say nothing of the enormous decrease in discomfort and suffering and the loss which cannot be calculated, due to lowered efficiency.

In the entire Bell System in this country there is given each year a course in preventive medicine known as the "Health Course for Women." This is entirely voluntary. During 1926 and 1927, the two years that this course has been offered, approximately 900 young women have been "graduated" each year. These young women are instructed in personal hygiene. They are taught how to eat, sleep, rest, exercise, walk and stand, they are also given some practical exercises in first-aid to the sick and injured.

Such efforts on the part of industry should be encouraged and enlarged upon and each industry should be educated along health lines.

In Michigan the State Department of Health is organizing a Bureau of Industrial Hygiene. We have up to this time made a survey of 28 industries of various kinds and have found the managements very willing to cooperate along the lines suggested. With such progress being made in industry, how long will it be before the slogan, "Have a Health Examination on Your Birthday," will have been translated from platform announcement to accomplished fact?

RACE BETTERMENT—WHAT CAN WE DO ABOUT IT?

OSCAR DOWLING, M.D., Professor of Public Health Administration, Medical School, Tulane University of Louisiana; President Louisiana State Board of Health

Race Betterment is not so simple as it sounds; in fact the problem is tremendously complex. There may be an intuition among men for race preservation. If so, it is not proved clearly by history.

There are two definitions of the complex term "race." Properly used it means the collection of human beings with certain specific mental and physical characteristics, language and folkways that differ materially from those of other groups of the genus homo. The other concept comprehends groups that are in no sense racially distinct, or those where there has been an influx of alien people. It is common to speak of the Nordic, the Alpine and Mediterranean races. In the proper sense of the term these are not races at all; they are mixtures of different distinct racial types; they are groups.

The Greeks, Romans, Goths were true Nordics; they did not maintain racial integrity, for each and all have strains of races far inferior. Even the Angles did not maintain racial purity. According to Dean Swift, you will recall, "the true born Englishman" was made up of Pict, Briton, Scot, "Norwegian pirates," "buccaneering Danes" and Norman French—of excellent qualities in each. Perhaps this is why the English drumbeat is heard around the world.

IS THERE IDEALISM BEHIND RACE PROGRESS?

To digress for a moment, there is no denying the capacity of the Nordic or mixed Nordic to govern and to organize. Progress in scientific development is largely due to the northern racial groups. Even their detractors grant them ability to systematize, to develop justice, to maintain peace and to promote order. The mutual understanding between the Scandinavian countries is a pertinent example. The other two groups, the Alpine and Mediterranean, have also played their part, but their influence for good has not been so great as that of the northern branch of humanity. We remember the ancient Greeks with their art, philosophy and culture; Rome with the vicissitudes of Republic and Empire, leaving in its fall an influence in law, which we recognize even in the 20th Century. Perhaps the original Romans, as well as Greeks, Goths and Gauls, were of pure racial stock, but admixture with Semitic, Slavic or Mongol peoples paved the way for the fall of the early civilizations of Greece and Rome, while the undermining of the

strength of character and high principles of the Gallic divisions by the admixture of hordes of barbarians left them a prey to degeneracy and weakness. Greece and Rome are examples of racial supremacy, achieving the supreme pinacles of mental and moral progress, and then declining, disintegrating, and finally disappearing altogether. They left a great heritage, which has strengthened civilization.

Were the Grecian, Persian, Roman, and in modern time the Russian and German, empires built on the fundamental impulses of their people? Are there some instincts that act collectively and irresistibly to drive huge masses of people to higher goals over long periods, centuries perhaps? Is there a primal urge to racial betterment, or is the whole theory nothing more than the shadow of the desire to dominate, to conquer, to subjugate? Is there altruism behind racial progress; is there idealism?

A cursory examination of that conglomerate of nationalities called Europe, Asia and America, affords little of racial idealism. Personally we are not pessimistic. We believe that, at least in the narrow sense, every nation, no matter how complex its racial constitution, has popular ideals that are good and lofty and that make for Race Betterment.

ENVIRONMENT A COROLLARY OF RACE BETTERMENT

That digression was longer than I intended and I now crave your indulgence for a second. To my mind, environment is a large factor in race improvement; in fact, environment is a corollary of Race Betterment. Logically each develops the other. Environment is dependent upon the psychology, the inherent characteristics, of the race or groups and upon the economic conditions that prevail in the locality. "As a man thinks so is he," and it follows that he will develop himself and his surroundings in accordance with his ideals. If he is esthetic, he will not be content with squalid conditions; if he has a tendency to thrift, the status of his home and immediate environment will give evidence of this quality; if he is of a lazy, inert, essentially indigent type, the result of these characteristics will be clearly evident. It is lamentably true that a large number of the last type gravitate to the lower strata of the population. The biographies of men worthwhile, who rose from humble homes to eminence, do not prove that they come from families of the lazy inert or criminal type, but do prove that by far the greater number originate from racial stock whose past history has shown high grade qualities.

But environment must be accepted and adapted. In the United States we have a condition of racial admixture that we have described as "the melting pot" and that has proved itself to be a gigantic fallacy for the reason that those whom we thought were absorbable, at least

after one or two generations, and could eventually be amalgamated into a composite whole, have shown themselves to have retained within their racial groups those characteristics that had always distinguished them. Environment has not modified the inner man. Superficially they have adapted themselves to their environment, but fundamentally they have remained the same. We have seen how a great calamity can immediately dissociate those elements of society which we had thought to be part and parcel of a concrete whole.

STERILIZATION HUMANE AND SALUTARY

We should not forget that from the classes that have completely failed to amalgamate are derived the greater portion of the inmates of our penitentiaries, insane asylums, homes for feeble minded, poor houses and other refuges for the "downs and outs." The question arises whether it would not be a good plan to prevent these persons, who cannot legally be incarcerated or confined or restrained in any way for their entire lives, from breeding another crop of degenerates, criminals and insane, such as they are themselves. In some states the idea has been put to practical advantage in that sterilization has become a statute. It is self evident that this can be extended greatly and that its advantages, while perhaps not evident in the present generation, if persistently carried out will be of enormous advantage to society as a whole in the generations to follow. It is my opinion that the sterilization of the unfit is one of the strongest incentives to a belief in the gradual improvement of our social conditions. It remains, however, to convince the public that sterilization is not only humane but that it is a salutary measure that will redound eventually to its own benefit. This is not an easy task. In many of the states the obstructionists and the maudlin sympathizers have prevented the passage of a sterilization act mainly because they were ignorant of the true facts.

SOME RACIAL STOCKS INIMICAL TO A RACE BETTERMENT PLAN

There are a few points in Race Betterment that stand out. People must be shown the value of intelligent mating. A family of good stock should select from another family having qualities that are recognized as strongest. Society can do something to help. We can suppress the degenerate and the unfit, restrict to a minimum the immigration of those racial stocks that are inimical to the Race Betterment plan. We have accomplished something in this country since the last immigration law was passed. Huntington says it speaks well for the determination of the dominant Nordic element of this country that it was sufficiently farsighted to resist all political pressure and fallacious argument with which it was deluged.

THE DANGERS OF AN INVERTED SOCIAL POSITION

There is another means by which we can attain racial betterment. This is by restricting the reproduction of the masses. Statistics show by intricate calculations that the street sweeper and the coal heaver will produce more than four children to every two that the physician, the lawyer, the college professor, in short the highest strata of our population, produce. If this be the case, it means that in the course of time the predictions of Stoddard, of East and of others will become accomplished facts. In other words, the Intelligentsia will eventually be crowded to the wall and they will be governed by the Mediocrity. We have had an excellent example of what happens to a people when this inversion of social position takes place. In the Russian Soviet Republic at the beginning of its régime, a state of affairs existed in which the ignorant and the vulgar mob ruled, and it was perfectly evident that in the lower strata of population the animal and the stupid were intimately combined in one body.

I think that this means that we shall eventually come to the point where we shall at least tacitly admit the value of birth control, even though we may not for many years openly advocate it. At present there is great opposition, on the part of those who cannot understand why there should be any restriction placed upon the number of children that a family should consist of. As a matter of fact there is no restriction upon the number. The restriction is directed toward the quality. It is quality that counts, not quantity.

PROPER EDUCATION CAN HELP IN MAKING A BETTER CHOICE IN MATING

Darwin stated in general terms that people in breeding do not give anywhere near the attention to the selection of partners that the stock breeders do. Eugenics is a science in its swaddling clothes, and much is still to be learned about mutations and variations in racial stock. Then there are the mysteries of the chromosome, and the gene in which the potential qualities of the new being are hidden. Looked upon from the standpoint of electrons and quanta of energy, these strange objects seem at first sight to render up their secrets, but even before we have obtained a mental conception of the intricacies, the profundity of the whole complex nature of our being overwhelms us. Even the most learned must pause in humility before the threshold of the ultimate cause.

In this line of thought there is one thing of which we are certain—amalgamation of higher with inferior races has always been fatal to both. Some tribes of South American Indians refuse entrance to their districts because they fear racial extinction. This is a species of crude eugenics that constitutes the biological angle of Race Betterment.

Malthus, Darwin, Sir Francis Galton, Pearl and many others have laid the foundation of an understanding of racial improvement on the basis of selection.

While I do not mean to imply that improvement of the racial stock can be brought about by education, still I do believe that the proper training of the child will lead to an enhancement of his native abilities, as well as to the cultivation of those inhibitions that culture and social organization have developed. By this I mean that through education we can furnish the ideas that may lead the adult to modify his choice of a mate and not blindly to select him or her because of certain external physical qualifications. Again, we might conceivably be running contrary to the law of sexual selection. But we do not think that this is the case, for the reason that were everyone universally trained there would be a general tendency to admire those qualities that are conducive to Race Betterment, and to abhor or ignore those that tended to bring about the opposite. This is only a theoretical consideration, and might not be in accord with the facts as they appear. It will remain for the future to develop the race along those lines that I have indicated.

THE NATIONS ARE AWAKING TO THEIR PERIL

Of this I am sure: The nations are awakening to their peril. Even now the governments are struggling blindly to reach a solution of international problems which fundamentally are of racial origin.

Whether we believe it or not, the time is approaching when we shall be compelled to look at the facts of racial improvement, when we shall have to act, not in accordance with feelings of sentiment, but in accordance with cold judgment and common sense.

A BETTER AND HEALTHIER MAN

Dr. Henry F. Vaughan, Commissioner of Health, City of Detroit, Michigan.

The saying that if man is to reach the highest possible status of development physically, intellectually and morally he must have the aid of scientific research and discovery has been attributed to Descartes. Whether this French philosopher ever made such a statement or not is a matter of small importance. There is much truth in it, said or unsaid. Indeed there have been wise men at different periods in history who have held that one of the highest functions of mankind is to interrogate Nature, ascertain her secrets and utilize them as far as can be done in improving the conditions of life. In other words they have recognized the desirability of knowing our environment as thoroughly as possible and of adjusting ourselves to such environment. I know of no important scientific discovery that has not ultimately been of benefit to man. When Franklin was playing with his kite, the story goes that someone asked him of what use his observations would be. He replied by asking what is the use of a newly born babe? No one knows into what it may develop. It is needless to call your attention to what Franklin's discovery has yielded.

During the first half of the nineteenth century modern preventive medicine, which consists in the application of scientific discoveries to the limitation or the cure of disease, came into being. It has developed most rapidly and beneficially. That preventive medicine has added years, strength and efficiency to mankind is admitted by all. I will not occupy your time with figures supporting this statement, for they are now known and accepted by all intelligent men. While certain diseases have been greatly restricted, especially is this true of contagious diseases, I am not sure that any one of them has been entirely eliminated from the localities in which they have existed for centuries. It was the ambition of General Gorgas to accomplish this in the case of yellow fever. Soon after his death the International Health Board believed that this had been done as far as the Western Hemisphere is concerned, but subsequent outbreaks in South America make us speak with caution on this point, and the exact situation with a certain disease or group of diseases suggests even more caution when we include the whole world.

It is an interesting fact that contagious diseases have held to a marked uniformity in symptomatology and pathology. Smallpox, tuberculosis, the plague and certain other diseases seem to give rise to like

symptoms and cause similar lesions now to those they gave rise to before our era. In other words, there has been no marked mutation in the microscopic organisms causing these diseases during the long period of time covered. This is weighty evidence of the persistence of hereditary characters in these low forms of life. At least so I interpret it. It is true that the virulence of these organisms may be modified, diminished or increased, by subjecting them to altered environment, and these modified properties or functions may be transmitted through many generations. I will mention only one of the many examples of this that might be cited. The virus of vaccine is believed to be the same as that of smallpox, but the former has been so far modified by its passage through the cow that it is now used successfully in the prevention of the disease.

DISEASE REDUCED BY ALTERED ENVIRONMENT

I have said that modern preventive medicine is the application of scientific discoveries and observations to the prevention of disease, and this for the most part at least is done by altering the immediate environment under which man lives. Some of these procedures affect whole communities, large or small. For instance, the substitution of a pure water supply of a city for a polluted one protects or aids in the protection of all its citizens, although thousands of them may be wholly ignorant of what has been done. A like result is secured when milk is subjected to inspection, both at the stables in which it is drawn and during the period of its transportation to the doorstep of the consumer. When all of this is done by city ordinance or otherwise, all citizens reap the benefit. The same thing or like thing is true when the health department prescribes certain rules for the gathering, handling, transportation and storage of foods.

THE DEATH RATE HAS FALLEN FASTER IN URBAN THAN IN RURAL AREAS

The application of preventive measures to cities reaches and benefits a larger proportion of the inhabitants than is the case in rural areas. This is one of the reasons why the death rate has fallen faster and is now lower in urban than in rural areas. In 1890 the deaths from typhoid fever in New York City far exceeded those in rural New York, but the curves representing the prevalence of this disease have long since met and crossed and now the typhoid rate is lower in the city than in the rural area.

I say that this is one, possibly the chief, of the means, but it is not the sole means. The city spends more money on good health work. It employs a high grade sanitarian for health officer, supplies him with competent assistants some of whom are specialists in their respective

lines, builds and equips laboratories, detention and contagious hospitals, and in short renders her health service efficient.

That preventive medicine has within the past fifty years contributed largely to the improvement of the race, I do not think that any well informed man will deny. That heredity has had nothing to do with this accomplishment, I certainly will not claim or even admit. In the first place the men who made the scientific discoveries, the application of which constitutes the basis of preventive medicine, were, I have no doubt, men of good inheritance. There are at least three steps in the development of a scientific discovery and its application to the prevention or cure of disease. This may be illustrated by a short statement concerning tuberculosis, the deaths from which have been reduced to less than half since 1880.

HOW DEATHS FROM TUBERCULOSIS WERE REDUCED

In the first place, a French army surgeon, Villeman by name, fed guinea pigs and other animals on tuberculous sputum. He not only fed them but he introduced this infected material into their bodies in various ways, and learned that in all these cases tuberculosis developed. He introduced other foreign bodies, and found that in no instance did tuberculosis result. In this way he showed that the excretions from tuberculous lesions contain the virus that causes tuberculosis, and that in reality it is found nowhere else. Then the great German, Koch, took up the painstaking work of searching for the active agent in these secretions, and discovered the tubercle bacillus. The work of these two men constituted the first step in the limitation of tuberculosis. The second step consisted in the work of the medical profession all over the whole world. Thousands and probably millions of tuberculous secretions were studied and all were found to contain the bacillus. The third step consisted in the application of these discoveries to the prevention and cure of the disease—especially to the prevention. Tuberculous secretions were disinfected, sources of contamination and specific infection were ascertained and done away with, diagnostic clinics and dispensaries were instituted, visiting nursing service was provided, open-air schools, preventoria and day camps were constructed, and hospitals and sanatoria with the necessary bed capacity, and well-manned medically, were built and maintained.

THE HISTORY OF DIPHTHERIA ANTITOXIN

I cannot omit mention of another and very striking instance in which the original discovery seemed to be connected in no way with a medical or a health problem. In the eighties, Henry Sewall, Professor of Physiology in the University of Michigan, now a resident and practitioner of Denver, immunized pigeons to the venom of the rattlesnake.

As I say, nothing seemed more remote from a health problem than this, but what has come out of this work? Roux, at the Pasteur Institute in Paris, found that the toxin of diphtheria resembles in some important respects that of snake venom, and with the former he and Behring in Germany independently produced diphtheria antitoxin, which acts almost miraculously in both the preventive and curative treatment of diphtheria, once one of the most dreaded diseases and one of the most fatal in the world.

BETTER CITIZENS FROM BETTERED ENVIRONMENT

Heredity undoubtedly has played a part among men of science, especially among the earlier ones, who applied these discoveries. However, we are more interested in the influences that these discoveries and their applications have had upon the betterment of those who have received such benefits. Are they better citizens on account of the protection that they have had from disease, and on account of the better sanitary conditions under which they have lived? Are they better than they would have been under the environment that constituted the world of a hundred or a thousand years ago? I hold that they are.

That my position on this point is tenable is shown by the comparatively large number of immigrants of the first and second generation, who have contributed in many and diverse fields of learning to the extension of knowledge. Take for instance Michael Pupin, whose most entertaining book entitled "From Immigrant to Inventor" all of you doubtlessly have read. Had he remained in Servia, his native country, could he have done under the environment that surrounded him there the great work that he has accomplished? That intellectual excellence may be and often is transmitted by inheritance I am fully convinced, but that it sometimes springs up in unexpected places cannot be denied. Of course equal opportunity to demonstrate the possession of intelligence does not come to all.

It would be interesting should some statistician ascertain how scientific discoveries are divided between the descendants of those who came over on the Mayflower and of those who came later in the steerage.

Never before in the history of the world has improved and greatly altered environment come so abundantly to so many people as has been the case in the past fifty years.

The advantages during the past few years in urban environment over rural is not confined to physical conditions; they apply quite as well to mental and intellectual affairs, and this must be taken into consideration. City schools are better on the average, though possibly this is now growing less marked, than rural. We are all acquainted with the little red school house, its cheapness, its lack of ventilation and of

other hygienic facilities. We are also acquainted with the paucity of knowledge possessed and exhibited by the teachers in these schools. The inferiority of a red school house in all particulars fortunately is now recognized even by those whose children attend them, and community schools with facilities for the transportation of the pupils are now being provided. If the next generation is not well educated, it will not be the fault of the present one. The little daughter of the city resident skips to school every morning in all kinds of weather on clean pavements or is carried in the family auto. She finds the building in every respect in a sanitary condition. On entering she passes under the eye of a trained nurse or a school physician and the early detection of any contagious disease is quite certain. If such a disease be detected or suspected, she is carried to her home, isolated so as to protect other children in the family, and if sent to the hospital she has from the beginning expert treatment. In fact, the greatest danger the little school girl has to pass in her journeys to and fro lies in the possibility of being injured by an automobile, a truck, or some other vehicle.

The whole of my adult life has been given to preventive medicine, first in connection with the Michigan State Board of Health, and secondly, as Health Commissioner of Detroit. I began service with the State Board of Health the day after I received my diploma as a sanitary engineer from the University. In other words, my time and energy have been fully occupied in attempts to improve the environment under which the people within my jurisdiction live. It may be that my work has caused me to look with too much favor upon the influence and effect of environment when I compare the factors in Race Betterment, environment and heredity.

WHERE IMPROVED ENVIRONMENT FAILS TO IMPROVE CITIZENS

Of one thing I am convinced, however, and that is that there are those who cannot be made over into desirable citizens by improvement in environmental conditions. The continued reproduction of these should be checked. They reproduce their kind abundantly and without any sense of responsibility. Statisticians say that the criminal and moron classes are multiplying at a rate far beyond that of the population at large. They include the criminal classes and those deficient in intellect, and a few of those who intellectually are at a par or above the average. I want to state most emphatically that neither education, even the higher education, nor perfect environmental conditions absolutely prohibit the development of undesirable propensities. This was shown a short time ago by the fact that two university graduates in Chicago were guilty of a most revolting crime.

CERTAIN CLASSES SHOULD BE DESEXED

I believe that certain classes of people should be subject to desexing operations, and that this should be done with the approval of the law. I would begin with those convicted of murder in the first degree. Whether these, in addition to the desexing, should be detained in penitentiaries or houses of correction would depend upon the circumstances surrounding the case. I believe that those who are convicted of burglary, especially those carrying arms, should be desexed.

I think that those who show themselves, during their school life, to be low grade morons should be desexed before they reach the reproductive stage. Then, after this operation, they should be encouraged to marry because marriage tends to stabilize and fix the location of these people. Indeed the state could afford to pay those of this class a small annuity as long as they complied with the details of the law. It is generally assumed and stated that it is the instinct of reproducing his kind that leads man to marry. I believe that this is not the case, and that reproduction is not always in the mind or even desired when this ceremony is performed. It is the mating instinct. One sex is the complement of the other. There is in each a feeling of incompleteness that is satisfied only by mating.

WE NEED NOT MORE CITIZENS BUT BETTER ONES

There are many happy homes without children, or with only one child or two children, and many unhappy ones with too many. The world is not crying out for more inhabitants. I know of no part of it, at least no considerable part, that is offering inducements to newcomers. The millions slaughtered in the World War are scarcely missed, either professionally or industrially. While many a vacant seat at table or by the fireside is a reminder of deep personal loss and intense bereavement, this is not felt in the active business world. A better distribution of workers may be and is certainly needed, but I dare say that this adjustment will largely take care of itself. What the world most needs today, and practically every part of it, is not more citizens but better ones. We are gathered here today to discuss the means by which this desideratum can be secured. We need to consider every possibility, to do it thoroughly, and to give our advice wisely. It would be very unfortunate for scientific men to rush heedlessly into any statements along this line. Still, I believe that certain steps are so plainly advisable that we can speak without hesitation concerning them.

THE RESPONSIBILITIES OF EVERY HEALTH OFFICER

Certain tasks that burdened the health department in cities a few years ago are now being transferred to other agencies where they can

be more efficiently administered, thus releasing the facilities and personnel of the health department for other work. This is particularly true in the field of general sanitation, where garbage disposal, the cleansing of streets and alleys, the supervision and inspection of plumbing installations, have become functions of a department of public works or a department of buildings. Every health officer must shoulder the responsibility of providing a pure and wholesome water supply for his citizens, but the function of securing and distributing such potable water belongs to a special board or commission charged with this duty. It is true that bacteriological and chemical analyses made at frequent intervals remains a function of the board of health. All of these tendencies, many of which are innovations, are desirable since the health officer can then concern himself more fully in the detection of disease, the institution of procedures to minimize the spread of infection, and the education of the public in the elements of personal hygiene so essential to the full enjoyment of good health.

It is now largely possible for the health officer to foresee the outbreak of epidemics, and by carefully planning his own restrictive procedures, and by taking into his confidence the citizens who depend upon him for protection from pestilence and outbreaks of infection, to minimize or even to prevent the spread of contagion.

MAN THE PRODUCT OF BOTH HEREDITY AND ENVIRONMENT

I am strongly of the opinion that man as we see him today is a product of both environment and heredity. The general environmental trend that has been so closely coupled with man's evolution from prehistoric days is most assuredly beyond human control. Nevertheless there are those more intimate environmental tendencies that are amenable to regulation, such for example as the temperature, the humidity, and the air movement of the room in which we work or sleep. There are those conditions in our environment, not infrequently classified as nuisances, that may be inimical to health and still are within the purview of human control. In like fashion we find certain hereditary tendencies that are well established, and others readily subjected to control by the application of a system of selection.

The modern health department has done much to improve the environment, has made it possible for man to live a longer and fuller life in our congested metropolis than he would live in the more rural and sparsely settled communities. This has come about, not by chance, but by the application of scientific measures that have been disclosed by careful research both in the laboratory and in the field.

During the comparatively brief period from 1900 to 1920, the average expectancy of life in the United States has increased from 49

to 56 years. It is not beyond the realm of the imagination to believe that in the next twenty years the average man may reach an expectancy of 70 years. The health department is but one agency that has played a part in creating this extension of the span of life. The successes in the past have been spectacular because we have been dealing with vast pandemics of disease. In the future they will be less spectacular, and will depend for their success to a great degree upon the rapidity with which knowledge respecting disease prevention penetrates the masses and finds response in the application of personal hygiene.

Uncontrovertible statistics prove that the man of today is healthier than his forefathers. Let us trust that during the next few decades we shall develop an even better and healthier man.

AN UNNECESSARY WASTAGE OF HUMAN LIFE

Dr. Louis I. Harris, Commissioner of Health, City of New York.

The vision of many people in the American community will have to be corrected by a process of education so that they will see more accurately and more keenly how vital it is for the economic, the social and the personal betterment of every member of the community to ensure an effective public health service.

PROPERTY VERSUS HUMAN LIFE

People now emphasize in their legislation and in their budgetary grants the value of property. The relative proportion of moneys expended for conservation of health through public health service, as against protection of property, indicates that we are still deficient in understanding of the unnecessary wastage of human life that is the result of neglect. People say that public health is purchaseable, but they are unwilling to pay the price to reap the unlimited dividends in the extension of lives that are useful to the family and to the community, and in the prevention of sickness and its attendant costs.

This is true as far as concerns the expectant mother, the infant, the child that is not yet ready to enter school, the school child and those in industry and in many other social relations.

TRIBUTE PAID TO DEAD WHO MIGHT HAVE LIVED

The neglect of the public health as a part of the educational curriculum in public schools, high schools and colleges indicates that much poetry written as a tribute to the dead might have been unnecessary if public health education had been expressed in collective, intelligent action.

THE HEALTH PROGRESS OF THE NORTH AMERICAN INDIAN

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Dismal statements are made from time to time as to the apparent decline in the Indian population. There is no question of doubt that the full blood Indian is diminishing in numbers due to the ever increasing proportion of mixed blood as the result of intermarriage with the white population. That, however, is as it should be, if there is to be a real solution of the Indian problem. The full blood Indian of the remote past has no place in our modern civilization. His customs, manners and usages are too violently in conflict with modern life to yield him a satisfactory position in the pursuit of his happiness. He must either assimilate with the white element or yield to the inevitable.

It is regrettable that there should be no very recent statistics clearly differentiating different degrees of blood and intermixture. The latest trustworthy data are for 1910, when the Census Office published an admirable volume which, it is to be hoped, will be continued in connection with the 1930 census and amplified in certain important directions. It gives a full account of the different tribes by names and localities. In that year the number of Indians enumerated in Continental United States was 265,683, of which 65.5 per cent were full bloods, 35.2 per cent were mixed bloods, while for 8.4 per cent the degree of intermixture was not reported. The number of full bloods that year was 150,053. It is probably reasonable to assume that today the number is somewhat greater.

The North American Indian is one of the most interesting and admirable types of mankind. He has many excellent traits deserving of sympathy and encouragement. Practically from the time of settlement, our Indians have enjoyed the special solicitude of the government and of associated agencies. It is only in recent years, however, that special attention has been given to health promoting agencies and in many instances too late to be of much service, for many picturesque and interesting tribes have entirely passed away.

INDIAN RACIAL STOCKS

The Indians represent many different racial stocks. One of the most important is the Algonquian, which includes such tribes as the Arapahos, Cheyennes, and Chippewas. They are particularly numerous in Michigan, Minnesota, North Dakota and Wisconsin. Another important stock is the Athapaskan. Of these the outstanding tribe is

the Navajo, represented in Arizona and New Mexico. The Navajo is probably the finest surviving type, from the physical and health point of view, today. Another important stock is the Iroquoian, which includes particularly the Cherokees who in former years lived in Georgia, Alabama and Tennessee. They were removed to the Indian Territory, which now constitutes the State of Oklahoma, but some remnants survive in North Carolina. The Cherokees have always been looked upon as the most intelligent, progressive and hopeful of our Indian tribes. They have considerably intermarried with the white population, and at the present time in Oklahoma only about 20 per cent are full bloods, possibly less. The Navajos, to the contrary, are nearly all full bloods. Another important stock is the Muskhogean. The most important tribes of this stock are the Chickasaws, Choctaws, Creeks and Seminoles, most of whom now live in Oklahoma with remnants in Mississippi, Louisiana and Texas. The Piman stock is represented by the Papagos, Pimas and Yaquis in southern Arizona, California and New Mexico.

Of the Shoshonean stock, the most picturesque tribe is the Hopi, who live in pueblos in Arizona and New Mexico. Of great importance is the Siouan stock representing the Indians of the Western Plains, particularly the Sioux and Winnebagos. Finally mention may be made of the Pueblo Indians, who are chiefly of Tanoan stock concentrated in New Mexico on a number of pueblos. Outside of Continental United States, we have a number of Indians in Alaska, chiefly Esquimos and Tlingits.

Our Indian population does not represent, therefore, a homogeneous but in fact a very heterogeneous type. What is good for one tribe is not necessarily good and suitable for another. These facts are often lost sight of in considering the pressing problems of the Bureau of Indian Affairs, which is now chiefly concerned with financial, educational and sanitary matters affecting the welfare of the Indian population.

An Indian in law is not necessarily an Indian in fact. It is on this account that the returns of the Indian Office are, as a rule, at variance with the returns of trained census enumerators. On June 30, 1927, the Bureau of Indian Affairs enumerated a total legal Indian population of 354,940, that is exclusive of Alaska. The Indian Office enumerated 180,000 full bloods, 64,000 half bloods or more, and 110,940 who were less than one-half mixed blood. The technical difficulties are best emphasized for the State of Oklahoma. Here the Office enumerates returns of the Five Civilized Tribes, which comprise the Cherokees, Chickasaws, Choctaws, Creeks and Seminoles, with a large number of

negro freedmen, numbering 4,919 in the Cherokee nation, 4,662 in the Chickasaw nation, 6,029 in the Choctaw nation, 6,807 in the Creek nation and 986 in the Seminole nation. These are the descendants mostly of negro slaves who were the property of the Five Civilized Tribes when removed to the Indian Territory, which is now the State of Oklahoma. Aside from these, there are a considerable number of white persons legally adopted as members of Indian tribes and entitled to annuities under the disbursement of Indian funds. It would require painstaking analysis of all the facts to make the returns of the Indian Office precisely conform to the returns of the Census Office. But treating the Indian population as a whole, irrespective of the degree of white intermixture, and disregarding the negro element, it is a safe assumption that we have at the present time as large an Indian population of full bloods and mixed bloods combined as we have had for fifty years past, if not a larger population.

One of the earliest efforts to bring order out of chaos is the highly interesting and instructive report on Indian Civilization and Education, published by the United States Bureau of Education under date of November 24, 1877. This for 1876 gives the total Indian population as subject to the Bureau of Indian Affairs as 391,882. This is a reasonably trustworthy statement, which may be accepted as conclusive for the present purpose. It might have been explained, however, that as far back as 1829 in the famous Morse report to the Indian Office, the Indian population at that time was estimated at 471,036. It is the largest estimate on record, but it is generally accepted as one of the best. The Morse report is one of the classics of Indian literature and the basis of most of our present information concerning the actual distribution of Indians at a given period of time in the earlier experience of the nation.

THE INDIAN'S SHORT LIFE SPAN

All authorities are agreed that at the time of settlement of this country, the Indian represented a marvelously healthy and robust physical type. One of the most recent discussions of the early Indian health is contained in a report on "The Rise and Fall of Disease in Illinois," by Dr. Isaac Rawlings, Director of the Illinois State Department of Public Health. According to Dr. Rawlings, "In consequence of his life he had a capacity for great and sustained effort and an ability to withstand hunger. He had a fine stature on the average and great physical vigor. To those diseases which threatened him in the wild state he had a fine resistance and yet he was short lived. He died at an average early age and there were few children in the average Indian family. It is not easy to understand why so fine a constitution

went hand in hand with a short life span and small families with children spaced far apart. History would indicate that wars and famines furnished the explanation."

Unfortunately most of the earlier writers on our Indians paid little attention to race pathology and physical anthropology. They were concerned with the picturesqueness of Indian life and that attitude has unfortunately continued up to the present time. That the Indian died prematurely is easily explained by the hardships of the life he suffered. But it was chiefly the introduction of European diseases, particularly smallpox, measles and venereal diseases, aside from alcoholism, that destroyed vast numbers long before their allotted time. A psychological factor also operated to discourage the native Indian in his struggle for survival. No one has ever traced the discouraging effects of a white civilization suddenly forced on a native race heretofore out of touch with its baneful influences.

Happily within recent years the viewpoint has changed. At the present time, the Indian Office has a well equipped medical department, amplified by a department of vital statistics, which within a few years should prove of the greatest possible value. The medical department is in charge of a highly qualified officer of the United States Public Health Service. To a considerable extent adequate hospital provision is now available, aside from a nursing service of great value. The status of the medical officers in the field has been raised during recent years to a more satisfactory position. Much requires to be done, but the responsibility for this rests essentially upon Congress. According to the Annual Report of the Secretary of the Interior for 1927, "The effects of the reorganization of the medical service of the Indian Bureau are becoming increasingly more apparent. The district medical directors visited nearly all of the jurisdictions within their districts and made many recommendations, for improvement of the service rendered, which were carried into effect. They have been able to establish with the state and local health authorities cordial relations that greatly assist the work."

This statement is fully supported by my own investigations, which have extended over more than thirty years. We have never had an Indian Commissioner more in sympathy with health-promoting efforts than the Commissioner we have at the present time, and with telling effect. I am satisfied that when the new statistics that are coming into being are available, they will present a reasonably satisfactory aspect, for it goes without saying that the situation is in very truth an exceedingly complicated one. As yet large numbers of Indians are backward in their appreciation of sanitary needs and to the requirements of public

health and personal hygiene. The only useful vital statistics of Indians are those compiled by the Census Office for the Registration States. Unfortunately these exclude the most important sections of Arizona, New Mexico and Oklahoma. But such as they are, they are useful as emphasizing the outstanding medical needs of the Indian population.

RACIAL SUSCEPTIBILITY TO RESPIRATORY DISEASES

During the calendar year 1925, for illustration, out of 2,956 deaths from all causes, 655 or 22.2 per cent were from all forms of tuberculosis. For reasons of racial pathology, the Indian is peculiarly subject to pulmonary tuberculosis and shows little disease resistance once he is affected. He is frequently unwilling to seek sanatorium treatment that would in many cases prove decidedly beneficial. The Bureau of Indian Affairs maintains a number of modern institutions, but not sufficient for the entire needs of the Indian population.

This disease during the last five years caused 22.5 per cent of deaths from all causes among Indians, against 7 per cent in the Registration Area. While essentially the question of Indian health conservation is one of tuberculosis prevention and cure, it requires to be considered that there are three fundamental elements in tuberculosis that demand consideration. There is first the question of sufficient food or adequate nutrition, to provide a high degree of disease resistance; second, satisfactory home conditions to safeguard as much as possible against the risk of direct infection, amplified by adequate sunlight exposure and good ventilation; third, there is a need of avoidance of fatigue or exhaustion. In this respect, Indians are often very careless and needless exposure is common.

But aside from pulmonary tuberculosis, the Indian is peculiarly subject to other forms of respiratory disease, including both types of pneumonia, as well as acute and chronic bronchitis. Lobar and other forms of pneumonia are nearly twice as common among Indians as among the public at large. Here again there is evidence of the greater sensitiveness of the respiratory system in Indians to unfavorable extraneous effects.

Measles have fortunately not prevailed of late years to an alarming extent. In 1925 the number of deaths from measles in the Indian population subject to the Division of Vital Statistics of the Census was only four. The Indian seems not to be susceptible to scarlet fever, for there were no deaths reported from this disease. He is also, to only a slight degree, subject to diphtheria, for only eleven deaths from this disease were reported. But there were 116 deaths from influenza.

Influenza prevails to the extent of 3.5 per cent of the mortality from all causes among the Indians, against 1.7 per cent for the Registration

Area. The entire Indian population suffered enormously from influenza during the epidemic of 1918-1919. I myself was on the Navajo Reservation at the time and observed the utter disregard of the Indian to all precautions advised by those competent to give advice. He seems to suffer a fatalism, once he is affected, yielding readily to fantastic methods but not to rational methods of prevention.

DIABETES, APPENDICITIS, PELLAGRA

Diabetes and appendicitis are of relatively rare occurrence. The question of accuracy of diagnosis may, of course, be raised here, but I am inclined to think that in a general way such cases would be diagnosed with reasonable accuracy in most instances. The appendicitis rate of Indians is about half the normal. It was 0.76 per cent of the mortality from all causes against 1.3 per cent for the Registration Area.

Pellagra is a rare disease among our Indians. There were only six deaths during the five years. There were 18 deaths from this disease in 1925. Anemia is relatively rare, while deaths from lead poisoning are not met with.

TYPHOID FEVER, MALARIA

Many of the earlier observations regarding diseases among the Indians are superficially arrived at. Thus the statement of Alexander Ross that, "If there was such a disease as typhoid fever in that day, there is no evidence that the Indian had it." At the present time the proportion of deaths from typhoid fever among our Indians is 0.58 per cent against 0.6 per cent for the total population of the Registration Area. In other words the two proportions are identical.

As regards the frequency of malaria, opinions vary, but I am strongly inclined to think that malaria is relatively rare. There were six deaths from malaria in 1924 among the Indians in the Registration States. Hrdlicka's statement that among the Nez Perces malaria is excessively prevalent seems to be doubtful, for I am not aware that malaria prevails to any measurable degree in that section of the country.

TRACHOMA

The Indian is unhappily peculiarly subject to trachoma, a painful and truly terrible eye affliction, often leaving total blindness. The problem that presents itself to the Indian Bureau in this respect is an appalling one. Here again, however, some progress is being made, and in certain directions excellent results are being secured. The problem here, as elsewhere, is ready conformity to qualified suggestions of treatment, which, unfortunately, are too often ignored. Yet even the Indian cannot deny the benefits resulting from modern treatment. To an increasing extent, such treatment is being sought by the more intel-

ligent portions of the Indian communities. It should be said in this respect that the Indian Bureau is working in this direction with the National Association for the Prevention of Blindness, while efficient aid is also being rendered by a number of Mission Hospitals and associated health-promoting agencies.

THE PASSING OF VENEREAL DISEASE

Venereal diseases are apparently diminishing; they are comparatively rare among Indians not in close contact with the white civilization. With the passing of new mining camps and army posts in remote sections, the social evil is being reduced rapidly. In 1925 in the Registration States, there were only twenty-two deaths from syphilis and none from the minor venereal infections. Progress in this direction is best indicated by the fact that while there were 22 deaths from syphilis in 1921 in a total mortality of 1,725, there were still only 22 deaths from syphilis in 1925 out of 2,956 deaths from all causes.

THE BENEFICIAL EFFECTS OF PROHIBITION

Alcoholism also is diminishing. Prohibition has for many years prevailed on all Indian Reservations and the sale of alcoholic liquors to Indians has generally been prohibited by federal law. It is probably safe to say that at the present time sales of liquor to the Indians are reduced to a negligible proportion. Deaths from alcoholism in 1925 numbered 11 against 3 during the preceding year. But this number may safely be ignored as an index of gross intemperance, which is exceedingly rare. Deaths from cirrhosis of the liver numbered only five. In my own close contact with Indians in the Southwest, I saw very little evidence of alcoholic indulgence.

RELATION OF LIVING HABITS TO CANCER

The same conclusions apply to cancer, which is rare and exceedingly so among tribes not in close contact with white civilization. I have for many years made a study of the incidence of cancer among our Indian tribes, and have carried on voluminous correspondence with local physicians all over the country in contact with the Indians, and the evidence is all to the same effect, that malignant disease is rarely met with.

In 1925, there were 62 deaths from cancer in a total mortality of 2,956, or 2.1 per cent. In 1921 there were 49 deaths from cancer in a total mortality of 1,725. During the entire five years ending with 1926, there have been 276 deaths from cancer in a total mortality of 11,807, or a rate of 2.4 per cent. This contrasts with an average per cent for the entire population of the Registration Area for 1924 of 7.8. It may be argued, of course, that the average age of the Indian

population is lower and that the proportion of aged persons is less. Granting this to be so, the differences are not sufficiently pronounced for the remarkably low incidence otherwise than on the ground that the habits of life of the Indian population are more favorable to a low rate of cancer than otherwise.

The Indians, broadly speaking, are mostly a rural population. They avoid contact with the irritating effects of our civilized life, and to a marked degree they still live on non-irritating or non-modified foods. I have briefly dealt with this question in my "Cancer in Primitive Races," but I have in progress a more extended investigation to be published in the near future.

DEATHS IN PREGNANCY, INFANT MORTALITY

Deaths in pregnancy occur in a fair proportion, but the mortality is less than would be expected considering the difficulties under which often children are born among the Indian population. Such deaths constitute 1.6 per cent for the Indian population against 1.3 per cent for the Registration Area. In 1925, there were 45 deaths in pregnancy among Indians in the Registration States, of which 17 were from puerperal septicemia. Much is being done to improve the conditions of maternal care, and infant mortality is apparently diminishing. Both the Women's Bureau and the Children's Bureau can do much good in this field.

Most of those who have written on native parturition are of the opinion that under ordinary circumstances labor is seldom painful and entirely physiological.

Infant mortality among Indians is still excessively high. Excellent progress is being made, however, through the influence of nurses provided by the government, also through field matrons, farmers' wives and other intelligent women, with whom the Indians come in contact.

UNCERTIFIED CAUSES OF DEATH

But the foregoing definite figures are subject to an important correction. The proportion of non-diagnosed, indefinite or unsatisfactory death certificates was 1.8 per cent for the Indian Registration Area against 1.5 per cent for the total Registration Area, including negroes. The new Division of Vital Statistics of the Bureau of Indian Affairs will make every possible effort to improve the situation and to bring about completeness of returns wherever it is possible. But it must be considered that many Indians die out of reach of medical attention and that the cause of death cannot be certified to with accuracy. It was rather surprising to find that the proportion of uncertified causes should not be larger. Progress in this direction depends largely upon Congressional appropriations for an augmented medical and nursing system.

OLD AGE

Another factor frequently mentioned is the lower average age of the Indian population. I regret that I cannot give precise figures upon this point but I am able to make the statement that, for 1910, the proportion of Indian population ages 51 and over was 12 per cent against 11.3 per cent for 1900. For the Alaskan Indians the proportion was lower, or respectively 8.7 per cent for 1910 and 6.5 per cent for 1900. The proportions vary widely for different racial stocks, or respectively from 6.6 per cent for the Muskhogean stock—including a considerable proportion of negro mixed bloods—to 18.5 per cent for the Teton Sioux. For the Navajos the proportion was only 8.1 per cent. But all such figures are, of course, influenced by fecundity, which varies for the different tribes. It is suggestive, however, that, according to the Census of 1910, there were in that year in the United States 187 Indians ages 95 to 99, and 116 Indians ages 100 and over.

Mis-statements of age or misconceptions are common, however, and pre-senility adds measurably to mistakes in appearances so that all age returns for advanced life must be accepted with caution. The fact remains, however, that old age is by no means so rare among Indians as is generally assumed to be the case, although there is no doubt that the Indian is shorter lived than the white race.

NEEDED STUDIES OF INDIAN PHYSIQUE AND LIVING HABITS

It has not been possible for me to go exhaustively into the more involved aspects of this question. Much remains to be done before we can deal with the question in a really satisfactory manner. In 1908, there was published by the Bureau of American Ethnology a treatise on "Physiological and Medical Observations Among the Indians of Southwestern United States and Northern Mexico," by Dr. Ales Hrdlicka. This treatise is the only adequate treatment of the subject so far presented. It includes extended observations on the physiology of the Indian, amplified by medical observations; Indian conceptions of disease; Indian methods of medical treatment; native foods, and some data on physical anthropology. There is most urgent need for work of this sort on a much larger scale. We require to know more about Indian physique, and particularly bodily proportions, before we can reason to much advantage regarding the most hopeful lines of prevention likely to yield results.

Of particular value are investigations into Indian foods. What has been done thus far in this direction has been rather fragmentary, and much of it has been purely academic. In my own opinion the Indian is undernourished rather than overnourished, except past middle age.

Mere figures of height and weight are not sufficient for the purpose. But even these, if properly tabulated on a large scale, would yield useful comparative results. The physical proportions of the Zunis and the Hopis vary enormously from those of the Navajos and the Sioux. All Indian schools collect height and weight data, but unfortunately they have never been compiled on a large scale or put to much use. In brief, both as to physiology and pathology of the Indian, we are in need of much more information than is at present available. But as I have said before, the outlook in this respect was never more encouraging than with the present Indian Commissioner, who is in sympathy with any and all efforts that will promote Indian health and welfare.

NEEDED STUDIES OF RACE PATHOLOGY

But in a larger sense the problem of Indian health conservation extends far beyond the interests of the government. It is regrettable that race pathology in this country should never have been made an essential part of our medical education. I have long been of the opinion that for both the Indians and the negroes, a special type of medical education is required. Now that the Indian medical service rests upon a more secure basis and holds out better prospects for the future, it is to be hoped that before long there will be an Indian Medical Association holding annual meetings and issuing a publication of its own. It admits of no controversy that the Indian is relatively immune to certain diseases common among the white population, but for reasons entirely unknown or not understood. It also admits of no controversy that he is peculiarly liable or particularly susceptible to certain other diseases, which do not seem to respond to methods of treatment in vogue among the white population to the same degree. The literature on medical observations among our Indian populations is surprisingly small, yet a vast experience has been had that should long since have been made a matter of record and discussion.

SUMMARIZING THE EIGHT INDICTMENTS OF CONDITIONS AMONG INDIANS

I was led to inquire into the vital statistics of Indians for recent years, in the light of recent experience, after reading the indictment of conditions among our Indians as presented in a report to Congress, dated January, 1913. There are eight indictments, each of which will be separately considered:

1. "Trachoma is exceedingly prevalent among Indians." This is unquestionably a fact, but for adequate measures of control, Congress is largely responsible. What is now being done should within a few years bring about a material reduction. Thus, during the present fiscal year, two schools in Arizona and New Mexico were selected for the

reception of children afflicted with trachoma and for their treatment by a trained personnel. Other schools have been set aside for the use of pupils not infected with trachoma. I regret that I cannot furnish definite statistics at this time, but I am informed that the situation is gradually being brought under effective control.

2. "Tuberculosis among Indians is greatly in excess of that estimated for the white population." This is a problem of race pathology rather than otherwise, but here again neglect on the part of Congress to provide adequately for the medical and sanitary needs of the Indians in former years lies at the root of a still deplorable situation. This being granted, it remains to be said, however, that the Indian himself is an exceedingly difficult person to deal with when afflicted with tuberculosis, and that progress can be made only by slow degrees.

3. "The sanitary conditions upon reservations are, on the whole, bad." This is no longer true, for it may be said without fear of contradiction that on all the reservations sanitary conditions today are reasonably satisfactory. This applies also to non-reservation schools or to settlements. Sanitary conditions are jointly looked after in most cases by federal and state authorities, and improvements are constantly being made in whatever direction they may be required.

4. "The primitive Indian requires instruction in personal hygiene and habits of living in stationary dwellings." This is an exceedingly difficult task, requiring, as it does, interference with long established customs and usages. It is an open question whether, in the case of the Plains Indians at least, living in stationary dwellings is as conducive to good health as living in the more primitive manner. It has often been asserted that modern housing in the case of Indians has really been harmful. Personal hygiene unquestionably requires material improvements in every direction, but this, as in the case of the white population, takes years for its ascertainment. Yet progress is noticeable.

5. "The sanitary conditions in most Indian schools are unsatisfactory." This is no longer true, for all sorts of Indian schools that I personally visited presented a reasonably satisfactory sanitary condition. The Bureau of Indian Affairs insists on unconditional conformity to accepted rules and regulations that meet reasonable requirements. The children in many instances are, of course, of a very primitive type, and cannot be expected to improve their sanitary needs as readily as children in more civilized parts of the community.

6. "There is danger of the spread of tuberculosis and trachoma from the Indian to other races." This danger is much exaggerated. If the diseases are contracted on the part of the whites or others, it is their own fault rather than the fault of the Indians. The danger is

rather the other way, in that most of the infectious diseases contracted by the Indians are from those with whom they come in contact.

7. "Due care is not taken in the collection and preservation of vital statistics." This deficiency has been made good within a recent period, and the Bureau has now a competent statistician in charge of the duty of supervising the collection of vital statistics and their proper analysis for practical usefulness. In part this duty rests on the United States Census Office, which has published for some years vital statistics for Indians or for such Indians as are living within the Registration States. The material available is useful and on the whole trustworthy for practical purposes.

8. "The medical department of the Indian Bureau is hampered by insufficient authority and inadequate compensation." The Bureau has now sufficient authority required for the purpose. The compensation of the medical staff has materially increased within recent years, but further additions would be desirable. The hospitalization of sick Indians is making progress. The Medical Department of the Indian Bureau is now in charge of a thoroughly competent and long experienced officer of the United States Public Health Service. Material improvements may, therefore, be anticipated in the future.

Thus the eight charges made in the report to Congress about twelve years ago are no longer applicable, nor are they suggestive of really unsatisfactory conditions. Naturally the evidence of such efforts as have been made during more recent years will not become apparent for some time to come. It is to be hoped, however, that the Indian Bureau will vigorously prosecute its statistical investigations, and will provide in due course a body of trustworthy facts acceptable to the public.

FECUNDITY AND RACE SURVIVAL

I am not prepared to give exact figures on the Indian birth rate, but the general indications seem to be that annually the number of births somewhat exceeds the number of deaths. While this would indicate a stationary population, our returns, unfortunately, do not cover the whole Indian population with sufficient accuracy to justify a final conclusion. For some of the larger tribes, I am inclined to think that not only is the population maintaining itself but that it is actually making a measurable increase. This is particularly true of the Navajos. The problem everywhere is complicated by intermixture with the white population. We meet everywhere people of Indian origin who pass entirely for whites. I have among my personal acquaintances at least a half dozen persons whom one would never think were of Indian origin, but who are proud of their Indian blood. It is, of

course, entirely debatable as to whether or not such persons should be classified as Indians, but they indicate the survival of Indian traits that constitute a most valuable addition to our American national life.

The proportion of sterile women among the Indian population in 1910 was given as 8.8 per cent. It was 10.7 per cent among full bloods and 6.7 per cent among mixed bloods. The details for differential degrees of intermixture are highly interesting, but they cannot be enlarged upon on this occasion. An analysis was made of 7,548 Indian women, 15 to 44 years of age and married from 10 to 20 years. Of these 16.9 per cent had not more than two children; 44.9 per cent had had three to five children, while 38.2 per cent had had six or more children. This would not indicate a lack of fecundity among normal Indian women.

The vitality of children born was also encouraging. Out of 36,277 children born to Indian women, 77.4 per cent were surviving, but for full bloods the proportion was 69.7 per cent while for mixed bloods it was 79 per cent, indicative of the effect of a higher status of culture, particularly with reference to postnatal care. With further reference to the percentage of women bearing no children, it is shown that for those whose parents on both sides were full bloods, for Cherokees the percentage was 7.3, for Chippewas 10.3, for Sioux 7.6, for Apaches 7.9, and for Navajos 9.3. The average number of children born to full bloods of the different tribes mentioned was as follows: Cherokees 3.7, Chippewas 3.7, Sioux 4.1, Apaches 3.7, and Navajos 3.5. These statistics bear a favorable comparison with the corresponding data for the white population.

In concluding his report of 1877, Dr. S. N. Clark, in behalf of the United States Bureau of Education, stated that "The usual theory that the Indian population is destined to decline and finally to disappear, as a result of contact with white civilization, must be greatly modified, probably abandoned altogether." With this conclusion, I am in hearty agreement. It would seem to me entirely appropriate, however, for the Commissioner of Indian Affairs to appoint a special committee to review these early observations, to bring the material down to date and to provide an adequate amount of facts for the purpose. Such a committee should have representatives from the Smithsonian Institution, the Bureau of Ethnology, the Board of Indian Commissioners, and perhaps from the Heye Indian Museum; also from the Museum of History of New York, and from the University of California.

The report of Dr. Clark contains, for example, a return of 6,538 births among the Indians during the three years 1774-76 and 5,306 deaths, a ratio of 12 births to every 10 deaths. The Census Office for

the three years 1922-24 reported 8,145 births and 6,651 deaths, or a ratio of 12 births to every 10 deaths, identical with the earlier observations. These figures would indicate, therefore, no material progress in life conservation, but as I have said before the present situation is enormously complicated by the vast amount of intermixture of the Indian population with the white population. But the data reemphasize the previous conclusion that the vital statistics of the Indian Office and those of the Division of Vital Statistics of the Census Office should be subjected to a thoroughly critical consideration and brought together in consolidated form to be available for further studies on the part of those who are concerned with this important subject.

In 1853 Herman Burmeister, Professor of Zoology in the University of Halle, published a classical essay on the Black Man, or "The Comparative Anatomy and Psychology of the African Negro." This essay, long out of print and difficult to obtain, presents some exceedingly interesting observations suggestive of a similar study of the racial pathology of the American Indian. If the Indian is to be saved from dying out, health conservation efforts in his behalf must rest upon a decidedly more adequate medical and physiological basis than is at present available.

Questions of racial psychology also enter into the problem. Years ago the opinion was advanced by a learned German that the Hawaiians were not dying out because of alcoholic liquors, or European dress, or European diseases, but because of discouragement in being confronted with a totally unlike civilization, which they found impossible to assimilate. In behalf of his own efforts the Indian is entitled to the utmost solicitude and sympathetic consideration. He represents a brave and admirable race whose traits in many respects are superior to those of the whites. His continuity in American life is from every point of view to be desired and to be encouraged. But viewing dispassionately the present situation, particularly as regards the modernized attitude of the Bureau of Indian Affairs, there is every hope for encouragement that a better day is dawning and that what remains of this picturesque and inspiring type of mankind will not suffer the fate of so many of the tribes that once were powerful and influential but now have passed away forever.

IDEALISM THAT GOES TO WORK

Dr. F. P. Miranda, Special Representative of the Mexican Medical Association and of the Mexican National University

The University of Mexico and the Mexican Medical Association have been honored by a very kind and thoughtful invitation from President C. C. Little and from Dr. John Harvey Kellogg to send their representatives to this Conference. Both Dr. Pruneda, Rector of the University, and Dr. Taldes, President of the Mexican Medical Association, regret very much not to be able to attend personally. They have been kind enough to delegate me as their personal representative.

We take this invitation as a sign of the friendly relations that fortunately exist between our countries, specially between those of us who speak the universal language of science, as has been proved conclusively by recent events on the occasion of Lindbergh's visit to Mexico. I am here to do my best to foster these friendly relations, and to learn the high lesson that representative men in the first rank of scientists of this country and of the world are giving us in these unforgettable hours, lessons that I shall carry to my country as a most treasured gift. We have been hearing words that carry inspiration for the greatest ideals of mankind. We have heard philosophical points of view that touch deepest chords of our souls and stir our thoughts and dormant energy in the most surprising way. We may not agree with all the ideas that have been set forth, but we are sure to gain by them.

Mankind has oscillated between individualistic and collectivistic points of view, touching extremes in a pendulum-like movement without finding peace in the possession of truth. Also we touch the extremes between egotistic and altruistic points of view in ethics, and sway from biological materialism to spiritualism, in our conception of man. But in the problem of Race Betterment, we must take our stand and try to lay the foundation of our work in a practical way.

SHALL WE QUESTION THE RIGHT OF THE FEEBLE TO LIVE?

The practical point of view is this: Shall we aid Nature, following Nature's ways, eliminating the unfit, increasing the struggle that life represents to them? Shall we rush onward in life's path, with all our power and with our eyes far away on an uncertain imaginary future, without heeding those who are trampled in our way, those who are weak and cannot follow us, who pray to us that we give them our hands to aid them? Shall we question the right of the feeble to live? Shall we see them as our liability and never as an asset? Shall we enforce health? Shall we enforce ethics?

We have been trained by our profession to go to the aid of the feeble and of the sick. We have been taught to struggle for the life of others, more than for our own. I am a physician, I am not a philosopher. I believe that the only idealism worth while is that which goes to work. Trying to do my part, I am forced to think philosophically again, and to ask what is the race? Should we believe in Plato's conception of genera? No. The individual is the only reality that I can get hold of. To be practical, we have to be individualistic; we have to work for the individual if we are to work at all. I am convinced that whatever we may do for the good of the individual we are doing for the race.

Beethoven, the genial composer, was deaf when he wrote his masterpieces. Would he have been rated as unfit?

RACE BETTERMENT IN MEXICO

Drs. Alberto Lozano and Margarita G. de Lozano Garza, Special Representatives of the President of Mexico.

It would be a vast problem to outline all that we have done and are doing in Mexico in promotion of maximum human well-being. I will, therefore, touch only on some points that we consider valuable to children in behalf of their successful development to youth, adulthood and old age.

INDIVIDUAL EXAMINATIONS IN SCHOOLS

The Secretary of Public Education, as an example, with clear, far-reaching vision for the future of our race, has formed, independently from the Department of Health, an efficient Service of School Hygiene, conducted by a large group of specialized physicians and a great number of trained nurses. This Service of School Hygiene has in its program the periodic examination of pupils and inspection of the schools, and has promoted the betterment of the buildings and school material. The results are well known, and appreciated. The service has increased pedagogic efficiency, and has brought about proper classification and grouping of the pupils as a consequence of innumerable general and individual physical and mental examinations.

SPECIAL SCHOOLS FOR PHYSICAL AND RACIAL BETTERMENT

Thanks to the close cooperation of medical and psychological research workers and to scientific grouping, we have been able to obtain surprisingly good results in the education of children. The physical education of children, conducted by a great number of well trained professors, in the establishment of School Policlinics, the inauguration of special schools such as Home-Schools, Out-of-Doors Schools, Schools for Native Indians, are the most valuable contributions to the physical, mental and social betterment of the Mexicans of the future.

Another example, of the many activities undertaken in bettering the race, is clearly shown in the organization of school breakfasts and lunches freely given to children found by the School Hygiene Service to be in a state of undernutrition that could be corrected by dietetic means.

SPECIAL COURSES IN PUERICULTURE AND PEDIATRICS

The Secretary of Education likewise contributed to the betterment of the race in establishing some years ago in the curriculum of the School of Medicine of the University of Mexico special courses in puericulture and pediatrics for physicians and midwives, and in pur-

suing the teaching of puericulture in popular terms, either in the primary and secondary schools for girls, or in Mothers' Clubs where many women who are acutely interested in the future of their families get together.

THE WORK OF "CENTERS OF HYGIENE"

A few years ago we began to be interested in eugenics, and in the First Mexican Congress that was held one decade ago in behalf of the child, some of the papers there read were written on different eugenic problems. These papers called attention to the possibility of obtaining in the human species individuals better and better adapted to a happy and useful life. Without stopping to enumerate all of the considerations involved in the influence of the parents' state of health on the child to be born, we have accepted that it is the state of health of the mother that more decidedly affects prenatal life. Thus having set our eyes on women who are about to be mothers and on the children that are to be born, as the lines to be followed in our eugenic purposes, the Department of Public Health opened two institutions, which will soon be followed by others in several states—institutions that we call "Centers of Hygiene."

These Centers comprise two sections, both very important, the Section of Infant Hygiene and the Section of Prenatal Hygiene. It is my intention, in accordance with the title of this paper, to deal specially with the second.

PRENATAL CARE

The section of Prenatal Hygiene is conducted by physicians specialized in obstetrics and gynecology, and aided by specially trained nurses in public hygiene and obstetrical work.

A social worker's office, a room for physical examination, chemical and bacteriological laboratories, and a room for treatments constitute the Section.

The clinic is opened all mornings, and the number of pregnant women admitted is not limited.

Following an investigation of the life of each patient, in all that pertains to her work, dwelling, food and other details, and having ascertained the hereditary and pathological and maternal history, together with the details of evolution of her present pregnancy, a thorough physical and obstetrical examination is made, followed by laboratory examinations of the blood, vaginal secretions, urine, sputum, etc.

Once the complete diagnosis is established in each case, and case history records filled, the proper treatment is instituted.

Those pregnant women who are found to have some illness (and the most frequent illnesses encountered are venereal diseases, syphilis,

and disturbances of gestation)—these illnesses are treated in the same Center, especially those found by the Wassermann tests to be syphilis. Other sick women are sent to various clinics and hospitals for their proper treatment and care.

EDUCATION OF THE EXPECTANT MOTHER

Mothers are instructed as to their proper food, baths, work, rest, sleep, about the defects of their homes, and about bad habits very frequently found.

From time to time those attending the Centers are invited to simple lectures and explanations on subjects, such as the hygiene of pregnancy and the proper manner of carrying out the feeding of their future offspring. These lectures are very willingly attended.

In a similar way they are usually instructed on the dangers of venereal diseases, chiefly those of syphilis, and on the influence of alcohol on their descendants, subjects that have also proved of great interest to them.

We believe that the results obtained are satisfactory, for our statistics show very clearly an increase in the number of children born alive, in those born on time and in those born with all the signs of being healthy—appearances later confirmed by observation of their development.

A Greeting to America from Mexico

We have brought to this country of wonders, on the occasion of this meeting of world-famed men of science, gathered by highest and sacred ideals, the most hearty greeting from our Government and Countrymen to the Government and Countrymen of the United States of North America—greetings that I pray you to accept in the name of Universal Fraternity to which so many of your great men have contributed.

Dr. Alberto Lozano
Dr. Margarita G. de Lozano Garza.

THE LENGTHENING OF HUMAN LIFE—IN RETROSPECT AND IN PROSPECT

Dr. Irving Fisher, Professor of Political Economy, Yale University.

When speaking to an audience like this of specialists in hygiene, I always feel that I owe it to them to explain how I, a specialist in an entirely different field apparently far away, should be talking on hygiene. I have never made any concealment of the fact that my interest was originally aroused by having been a victim of tuberculosis thirty years ago. After recovery, I discovered that there was a close relation between hygiene and economics; that the dictum of Emerson, "The first wealth is health," is an analogy not so very far-fetched.

In 1908 I was appointed a member of President Roosevelt's Conservation Commission for the express purpose of adding a report on National Vitality. In that report, in the writing of which I was aided by the best specialists capable of forecasting, I ventured to predict that, by the application of knowledge that we already had or that was in sight, human life could easily be extended by at least 15 years. It is interesting now to look back and find that, in the 20 years elapsing since 1908, when that report was written, almost all of those 15 years have already been added to the duration of human life in the United States and that the degrees of preventability that were estimated for the important diseases have for the most part already been reached.

THE LIFE-SAVING EFFECTED IN TWENTY YEARS

It was stated, for instance, that tuberculosis was at least 75 per cent preventable. So far as we have a record, since that date, already over 50 per cent has been prevented in the United States. In the experiment at Framingham, Massachusetts, conducted by the Metropolitan Life Insurance Company, a 69 per cent reduction in the death rate from tuberculosis was effected inside of seven years, showing that the 75 per cent estimate will probably be exceeded some day. Typhoid fever was estimated to be preventable by at least 85 per cent, and already a prevention of 87½ per cent has been effected. Diphtheria was estimated to be preventable to the extent of 70 per cent. Already over 80 per cent has been prevented, and we know that with toxin-antitoxin practically 100 per cent will be reached. Diarrhea and enteritis in infants was estimated to be preventable to the extent of 60 per cent and already 66 per cent has been prevented in the Registration Area of the United States and 79 per cent in 23 leading cities. Infant mortality in general was estimated to be preventable to the extent of 47 per cent

and already almost 60 per cent has been prevented. Diabetes we know will soon be on the way to virtual extinction.

On the other hand, there were diseases that were estimated to have some preventability and that have not been prevented. Cancer was put

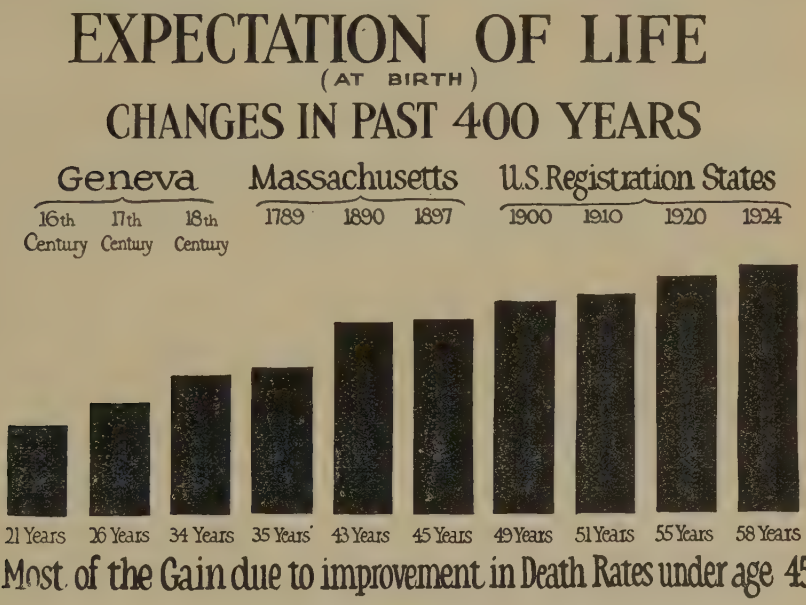


CHART I

down as zero per cent. In reality the record has been worse than that, as cancer has increased instead of decreased.

THE YEARS THAT LIFE HAS LENGTHENED

From Chart I you will see how life has lengthened, as far as we have record. In the sixteenth century the average duration of human life in Geneva, according to our best figures, was twenty-one years. In the seventeenth century the average was twenty-six years, in the eighteenth century thirty-four years.

In Massachusetts in 1789, it was thirty-five years; in 1890, forty-three years; in 1897, forty-five years.

In the United States Registration Area in 1900, we find forty-nine years; in 1910, fifty-one years; in 1920, fifty-five years; and in 1924, the last figure we have, 58 years.

THE RATE OF LENGTHENING

We find also that between the sixteenth and eighteenth centuries life was lengthening at the rate of about 5 years per century. In the first three-quarters of the nineteenth century, life was lengthening at

the rate of 9 years a century. In the last quarter of the nineteenth century, it was lengthening at the rate of 14 years per century; in Massachusetts, 17 years, and in Prussia, 27 years. In the first quarter of the present century life was lengthening, in this country, at the rate of 40 years per century, and in Germany at the rate of 60 years per century.

Now the question arises, Are we going to continue at this rate? What is the outlook now for the future?

Professor Hornell Hart, Professor of Sociology in Bryn Mawr College, with the courage of his convictions, has predicted that not only will the rate continue but the acceleration will continue, and that, therefore, in the year 2000, the average duration of human life will be over 100 years and babies will then be born destined to live 200 years.

If, however, we are to estimate in any such fashion as that, why should we stop at the year 2000? If we went on applying this rule, we should find that at the end of another century the average duration of life would be 200, and ultimately far beyond Methuselah's age; in fact millions and billions and trillions of years. More conservatively, a Committee of the American Public Health Association express the belief that 20 years could be added to human life.

Still more conservatively, Dr. Louis I. Dublin, statistician of the Metropolitan Life Insurance Company, estimated that we could at least add ten years to the present duration of human life. Dr. Dublin did not include in his estimate any improvement after the age of 70; he did not allow for any decrease in the death rate at the later years of life.

There seems, then, to be an obstacle to the prolongation of human life in the fact that at the later ages improvement has hitherto been non-existent, that only recently it has been in existence at all and then quite small. Most of the saving has been in infant lives. In the middle of the nineteenth century in England, one-quarter of all the people born would die before reaching the age of 5. In the twentieth century, on the other hand, in England this first quarter would not die until they reached the age of 40. In the middle of the nineteenth century, half would die before reaching 45. Now half will die only after reaching 65. In the last century, three-quarters would die before reaching 70. Today three-quarters will die only when reaching 75, that is, 5 years later, as compared with 35 years later for the first quarter.

IS ONE HUNDRED YEARS AN IMPASSABLE LIMIT?

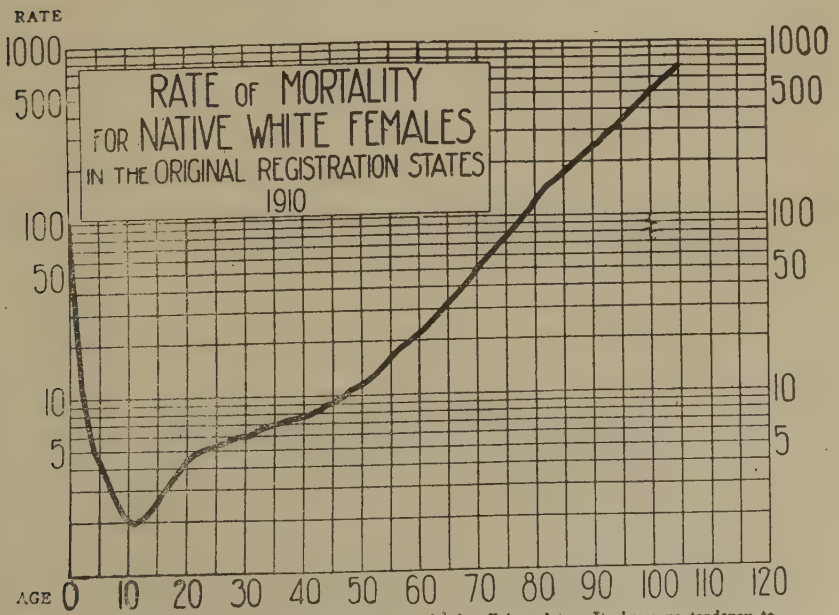
Actuaries have a sort of superstition that at the far end of the life scale there is no preventability; that one hundred years is an impassable barrier. One actuary told me that he thought it was possible to live to

99 or even 99½ or possibly 99¾ years, but he did not believe anyone had lived or could live, or would live, to be over a hundred!

The President of the English Institute of Actuaries, however, likewise a very hard-headed statistician and one who recognizes that most of the alleged centenarians are really not centenarians at all but cases of exaggeration, made a special study, individually, of alleged centenarians. After ruling out all the doubtful cases, he came to the conclusion that he could find in England twenty-two cases of genuine centenarians, the oldest of whom lived to be 105. He was obliged, in a second edition, to add eight more, and—what is of more importance—to extend the upper limit of age to 111.

Is this limit of 100 then absolutely impassable? Let us assume for the moment that it is and that we can, in each decade, add to human life only one-tenth of the difference between the present average age and this impassable limit of one hundred. This is the rate at which we have been increasing recently, about 4½ years per decade. If we keep on in this way, we shall find that at the end of the century we shall exceed 80 years. This does not seem unreasonable. But it does not seem unreasonable either that we can push forward this alleged impassable limit. In fact, the limit is a myth.

LENGTHENING OF HUMAN LIFE



The curve ends at 105 years only for lack of sufficient data. It shows no tendency to approach a limit, *i.e.*, a vertical direction.

CHART II

I myself know a lady in St. Louis who is 110. I looked up her records so that I think there can be no doubt about them. In Portland, Oregon, Mary Wood was investigated by the Historical Society of Oregon, and was found to have an authentic record of having lived to 120. Westergaard, the careful statistician of Denmark, investigated many such cases. The oldest that he believed to be authentic was a farmer named Drakenburg, who lived to be 146. He was married at 111. He proposed marriage again at 130, but was jilted. In spite of this he survived 16 more years!

Not only do we find individual cases where we exceed this supposed limit of 100 years, but if we take the statistics of the United States census as to mortality year by year, we find no evidence that one hundred years is an impassable limit. The death rate at birth, as we see in Chart II, is extremely high. When the age of 10 years is reached, the death rate is very much lower. From 11 on, the death rate increases quite rapidly until about 22, after which it shelves out somewhat, that is, increases rather slowly. At 45, it speeds up again. After reaching age 80 or thereabouts, it slows down a little and then increases at the same rate.

In this chart, the height of the curve represents the mortality, so that its slope represents the rate of increase of mortality. Although we have drawn this curve up to 105 years, you will see that it shows no sign of stopping. If 100 years were an impassable limit, this curve would approach a vertical direction. Even if such an impassable limit existed at 110 years, the curve would show some sign of turning upward. It shows no sign whatever of turning upward. It looks as though it were going to the northeast forever. Of course it is dangerous to extrapolate any statistical curve, and so I am not saying that this curve would go on indefinitely in this northeast direction; but we are safe in saying that there is no evidence whatever that it is going to approach an impassable limit.

On the contrary, as far as there are any statistics of the death rate of centenarians, they show that the curve tends to bend toward the horizontal rather than toward the vertical. Some special statistics on this subject were collected among Scandinavian clergymen by Westergaard. He found that those between 90 and 100 years of age have a death rate of about one in three in each year; that is, at the age of 95 years one out of three will die within a year. Of those that are 100, on the other hand, only one in four will die each year.

It is quite possible that out of a thousand centenarians, one out of the thousand lives to be 110, out of ten thousand such super-centenarians one of these lives to be 120, and so on indefinitely. There is every reason to believe that the chances of surviving are constantly dwindling,

and dwindling at an increasing rate, but there is, so far as I can find, no reason for setting any impassable limit.

MOST DEATHS "ACCIDENTAL"

There is also, in the wonderful work of Dr. Alexis Carrel, a suggestion at least that there is more possibility of life than we have hitherto dreamed. He and other biologists have given reasons for believing that the life cells, and many tissues, are potentially immortal. This is perhaps the most sensational conclusion that science has ever reached. Carrel has kept the cells of a chicken embryo's heart alive for sixteen years by washing out the poisons generated in the life process, by protecting against infection and by furnishing its ideal nutriment. Woodruff of Yale found no natural death in a culture of Paramecium in 8,500 generations, equal to 250,000 years of human life, and the culture was going as well at the end as at the beginning. One biologist tells me he suspects that some at least among the more highly evolved animals such as fish, which have no natural limit to their growth, have no natural limit to their age either. They, like cells, are potentially immortal. But this biologist thought that animals that have a natural time to stop growing had also a natural time to stop living; and biologists in general still seem to think that among higher organisms death is probably a necessary price paid for their high development and differentiation.

Yet, as a matter of fact, all the records of human deaths show that these deaths might properly be called accidental, due, if not to the invasion of a bullet or the collision with an automobile, to the ravages of germs. Evidently death from germs is as accidental as death from wild beasts. Without these external causes of death, would it necessarily be that we would die at all?

Metchnikoff believed in a natural death and we have a sort of superstition that there is one, but neither Metchnikoff nor anyone else has, so far as I know, given any substantial evidence of it. We all merely take it for granted. If there is any such thing as a natural death due inherently to our physiological processes, statistics do not show it. Chart II gives no hint of it. It shows no compact grouping of deaths about any particular age. We find puberty, for instance, occurring at practically the same age for everybody. So far as there is any variation among different individuals, the ages of attaining puberty show a compact grouping around 13 or 14, showing that puberty represents a natural physiological event. Why do we find such a scattering in the ages at which we die? Moreover, practically every death has an unquestionable external, non-physiological or accidental cause. If there is a natural age for dying, it must be far beyond the century mark. Metchnikoff put it off to 125 years or so. In other words, he believed that,

if we could get rid of accidental deaths, the only kind we ever see, we could live on the average perhaps 50 years longer than we do today.

THREE WAYS OF LENGTHENING HUMAN LIFE

How can we lengthen human life? There are three principal ways. The most important is by eugenics. I am delighted to see that in this gathering we have united two groups of ideas ordinarily opposed, those of the hygienist and of the eugenist. These often do not speak the same language; in fact, each is more or less contemptuous of the other. It cannot be doubted, however, that, for the ultimate welfare of the human race and for the ultimate increase of longevity, we must depend upon eugenics rather than upon hygiene; that hygiene without eugenics will be disgenic, and will give us a weakened race in the long run through the differential death rate and the differential birth rate. Alexander Graham Bell found that the average age of death of those whose parents both reached 80 years was twenty years more than the average age of those whose parents died below the age of 60.

But even if eugenics is the absolute ultimate solution, we cannot wait, because to this generation it would do no good.

The second method is by public hygiene. But must we depend upon public hygiene only? Moreover, this public hygiene that insures a pure air supply, a pure water supply and a pure food supply, that protects us all, more or less, from germs, is something beyond the control of the individual. The third method is, therefore, individual hygiene.

BETTERED PERSONAL HABITS WILL LENGTHEN LIFE

Now, I believe that if we look at individual hygiene, which means an improvement in the habits of living, we find here the explanation of the slowness of the change of the death rate at the upper ages compared with the death rate in the lower ages, and an explanation of the fact that hitherto our great success has been with infants and not with the old. In order to decrease the death rate after middle age, you must improve personal habits. I believe that the sticking point for mortality, especially after middle life, is concerned with individual hygiene rather than with public hygiene.

Individual hygiene can be imposed upon the baby because the baby is helpless, but when we try to impose individual hygiene on an adult, he resents it. If we try to legislate in regard to alcohol, which we know to be injurious, we find a tremendous resentment against Prohibition. I remember that when I had tuberculosis, in the West, I asked my physician why he did not tell what I had learned about the importance of ventilating rooms to all his patients, and he said, "I can't do that. I would lose my job. I would be regarded as interfering with what was none of my business." That is the attitude of the average

man, when you talk about drinking and smoking and eating—all those things that constitute individual hygiene. And yet, if we are going to get over this sticking point, if we are going to remove this *apparent* impassable limit of one hundred years, if we are going to reduce the death rate beyond age 70 as we have in the earlier ages, we must have a revolution in the habits of living.

STUDY OF GROUP OF 1000 INDUSTRIAL WORKERS SHOWING GAIN IN GOOD HEALTH BY CORRECTION OF DEFECTS NEEDING MEDICAL ATTENTION AS REVEALED IN PERIODIC HEALTH EXAMINATIONS

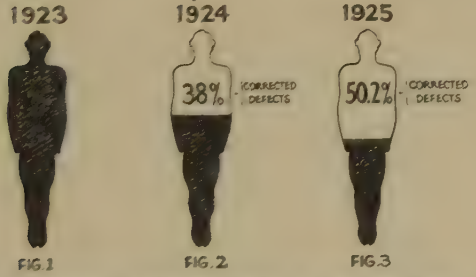


Fig. 1 represents the total number of defects found in group on first examination. (Need for correction then impressed upon worker.)

Fig. 2 Of these defects 38% were corrected by the time of examination in 1924. (Attention again called to uncorrected defects.)

Fig. 3 A year later 50.2% of defects had been corrected.

CHART III

THE VALUE OF PERIODIC MEDICAL EXAMINATIONS AND HEALTH EDUCATION

How can it be brought about? It often occurs sporadically in cases like Cornaro's or Dr. Stephen Smith's, where a careful hygiene is practised enthusiastically. Smith lived to 99, and Cornaro, who had broken down in his 30's, is claimed to have lived to 103. On a larger scale, though usually in a smaller degree individually, hygiene can be induced through periodic medical examinations, such as have been initiated by

the Life Extension Institute, Inc. It can be done likewise through the preachment of physicians to their patients, if they will take up in earnest this form of preventive medicine.

When the Life Extension Institute was started, it was said that only those would patronize it who were self-selected; that it would not represent a cross-section of the community. In Chart III, we see what happens to a cross section of industrial workers who are examined in a group. One hundred per cent of them are found to have something the matter, some room for improvement through individual hygiene. Of their defects thus found, thirty-eight per cent disappear within a year, when the examination is repeated, and over 50 per cent disappear within two years. So we see that it is possible even among workers to induce them to practise some individual hygiene.

In women's colleges where special efforts have been made to secure a more hygienic life, the death rate has been reduced to less than one-third of that of the general population of the same age and sex. I do not see why this cannot some day be done generally. In fact I will make bold to say that even in these women's colleges only the surface has been scratched. The possibilities of modern hygiene, to the individual who is willing to pay the price, are, I believe, far beyond anything yet attained. Like Christianity, an ideal hygiene has never been found.

I will close, then, simply by pointing out that: While eugenics cannot apply to the present generation, while public hygiene is beyond the control of the individual, and while individual hygiene for the masses will be a long time in coming, those of us here and now who are willing to break with tradition and to follow science as our leader may obtain benefits that to the human race generally can only be expected to come in future centuries.

THE OUTSTANDING UNSOLVED PROBLEM OF THE HUMAN RACE —THE INCREASE IN THE SPAN OF LIFE

Improvement in Mortality Rates and Expectation of Life in the United States from 1890 to 1920

Dr. James W. Glover, Professor of Mathematics, University of Michigan.

The problem of Race Betterment is qualitative and quantitative. We shall deal only with some of its quantitative aspects. It is one thing to be alive and in full possession of those physical and mental faculties that come with freedom from disease and favorable inherited tendencies and quite another to be substandard in vitality and ability to think and act. But when we deal quantitatively with longevity, we are obliged to depend upon data that tell us only that man is alive or dead. This dichotomy is peculiar to the population and vital statistics gathered by our Census Bureau. We can take no account of the man who is half dead. We count him as living to the same extent as the most splendid physical specimen in our broad land. He is a unit either in the census or in the death register.

From this mass of raw data every ten years we construct life tables. Census statistics may be regarded as the journal entries of our bookkeeping, and the life tables as the periodic balances that we strike in the ledger of life. They tell us nothing about ourselves as individuals, but reveal many interesting and important things about us as we are in the aggregate. If men are going to live and die during the next two or three decades under the same essential conditions as during the last decade, life tables enable us to predict the rate of mortality, expectation of life and numerous other things for each year of age with remarkable precision. So certain is this forecast that one of the greatest activities of modern civilization, the insurance of lives, is based on life tables and is generally regarded as the most stable financially among them all.

ARE WE HEADED TOWARD SUBSTANTIAL IMPROVEMENTS IN LONGEVITY?

We shall take the figures from 1890 to 1920 furnished by the Census Bureau at their face value and draw from them the best conclusions we can, whether or not they agree with what we would like them to be. They are disappointing in some respects because they lead to the conviction that we are not strongly headed towards substantial improvement in longevity, if we understand by this term that most men can reasonably expect in the near future to live to be eighty years of age or over. Our life tables show that in this country since 1890 the aver-

age length of life at birth has increased at the rate of about five months per year from forty-three years to fifty-five years, or more than twelve years in all. Nor is there as yet a decided diminution in the strength of this tendency towards improvement. What, then, is the cause for apprehension? An analysis of the distribution of this gain will show the weak link in the chain, and reveal some very disturbing factors.

Writers and lecturers—and through them reports in the press and magazines—have fixed attention too closely upon this steady increase of the expectation of life at birth. They have predicted for man an average span of life of one hundred years, and even one hundred and fifty years, at a time not far away. The oft repeated statement that we have increased the expectation of life fifteen years in the last three decades followed by the prediction that we may expect to double this gain in another quarter century is absurd, if we take all the implications of our life tables at their face value. What stands in the way of this advance?

THE EXPECTATION OF LIFE AT BIRTH NOT A GOOD MEASURE OF LONGEVITY

We are all accustomed to the idea that general death rates cannot be employed to compare the standard of health and mortality in two communities unless the age distribution is the same in those communities. The expectation of life at birth is the reciprocal of the general death rate, and if one is not a good measure the other can be no better. A little consideration will also show that the expectation of life at birth taken alone is not a good measure of longevity. The age distribution of this gain must be determined. If it is all or nearly all under age fifty, it cannot be inferred that those who are living at ages beyond fifty are any better off than before. If the rates of mortality beyond age fifty remain the same, the expectation of life at this age will not be changed and we have only nursed more people up to the age of fifty to be leveled off by the grim reaper in the same ratio as before. These rates unchanged will kill off ten million people at the age of fifty and over in the same time and proportionate incidence as ten thousand people.

IN SOME STATES MORTALITY RATES AT OLDER AGES HAVE INCREASED

Mortality rates during the last thirty years at ages beyond fifty have not shown a satisfactory decrease. In fact, in some states, for example Michigan, the rates at these older ages have actually increased since 1901. In the original Registration States the gain in the expectation of life at these ages during the first twenty years of this century has been practically nil. In Massachusetts during the thirty-year period 1890-1920, the improvement in expectation of life at age fifty-two has been less than three months. At age seventy-two the result is negative

and men and women at this age in 1920 may expect on the average to live half a year less than those at the same age in 1890.

SITUATION IN LARGE CITIES MORE HOPEFUL

The situation is more hopeful in the large cities; New York, Boston and Chicago show an improvement of between one and two years in the expectation of life at age fifty-two; and it is likely that a similar condition exists in the other large cities. Apart from this there is no such decided tendency for improvement at these older ages as is shown during the first twenty years of life.

Many able writers have studied the possibilities of improvement in longevity by setting up hypothetically attainable mortality rates with a view to ascertaining the increase in expectation of life at birth. The answer has usually been between sixty and sixty-five years, a possible gain of ten to fifteen years over present average conditions. Too often these results are so promising that the author or his interpreters assume that a further lowering of mortality rates would add another fifteen years to the average lifetime at birth. But there is a limit to these possible gains.

IMPORTANCE OF IMPROVING OLDER-AGE MORTALITY RATES

Suppose that we go to the extreme and assume that all the agencies at work are so effective that infant mortality is entirely eradicated, even more, that there are no deaths during the first twenty-two years of life. Then *if the mortality rates beyond this age are not improved,* the expectation of life at birth would simply be twenty-two years plus the expectation of life at age twenty-two. This would give for the original Registration States, males of 1920, an expectation at birth of sixty-five years. If no deaths should occur before age fifty-two, the expectation at birth would increase to seventy-two years. This gives us some idea of the supreme importance of improving the rates of mortality beyond age fifty-two. Those who have attained this age are up against a fearful handicap and their chief hope for relief must come from those investigators who will find a way to reduce the rates of mortality at the *older* ages.

He is a hopeful prophet who will predict an average age of eighty, ninety or one hundred years for those who are born now, if the cold facts are faced. There is an absolute limiting value for this expectation at any age equal to the sum of the age and the expectation of life at that age. But unfortunately the value of the latter depends almost entirely on the rates of mortality at that age and higher ages.

THE MARKED DECREASE IN GAINS IN THE PERIODS BEYOND AGE FIFTY-TWO

We shall now turn our attention to a brief study of the incidence of gains in the expectation of life at different periods of life. For example.

we may well ask what gain has been made since 1890 in the *average* number of years one may expect to live between birth and age twenty-two. The application of simple actuarial formulas to our life tables enables us to answer this question. In 1890 for Massachusetts males the expectation was 16.04 years, in 1920 it was 18.81 years; thus a gain of 2.77 years was made for this period of life. For the age interval between twenty-two and fifty-two, the gain was 1.57 years; between fifty-two and seventy-two it was 0.44 years; and from seventy-two to age at death, it was —0.40 years; in other words, a retrogression. The same type of gain is obtained from the life tables for Massachusetts females.

Similar results are exhibited by other classes of the population. The notable thing in all of them is the marked decrease in gains in the periods beyond age fifty-two. The large cities, New York, Boston and Chicago, show much better gains in these older age intervals than the other classes of the population. The explanation of the gain raises an interesting question; perhaps a large measure of this gain in the cities may be accounted for through easier access to the best hospital and medical service.

THE OUTSTANDING UNSOLVED PROBLEM

What constructive measures, then, can we formulate to meet this outstanding problem? They must be far-reaching and involve much beyond what we are doing now. We must appeal to every effective agency to make a renewed effort at this point. Investigators in biology, genetics, eugenics, and bio-chemistry may discover methods more potent than those of the physician for prolonging life. When we reach a limiting point in the elimination of disease, the only one that remains is what we may call "old age." Most of us believe that human longevity is inherited, and this may give a promising lead. In recent years students of genetics have been very active in investigating those characters that can be strengthened through inheritance. There is a question as to whether the improvement of mortality rates through a recognition of inheritance of long life should not be the starting point, after medicine and all the other effective means with which we are familiar have been pushed to the absolute limit. The statesman and sociologist, the scientist in many fields, the educator and the enlightened press will all be prominent coworkers in this broader line of attack.

The increase in the span of life is now the outstanding unsolved problem of the human race. Its supreme importance to man from every point of view should command the effective support of individuals and governments through scientific foundations of the broadest scope and unlimited resources.

TABLE A

Expected Years of Life in Selected Age Intervals

Massachusetts

Expected Years of Life	*Males*			*Females*		
In Age Interval	IN 1890 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1890 YEARS	IN 1920 YEARS	GAIN YEARS
Birth to Age 22	16.04	18.81	2.77	16.43	19.34	2.91
Age 22 to Age 52	25.74	27.31	1.57	25.90	27.27	1.37
Age 52 to Age 72	15.32	15.76	0.44	15.84	16.19	0.35
Age 72 to Death	8.42	8.02	—0.40	9.18	8.61	—0.57

Original Registration States

In Age Interval	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth to Age 22	17.46	18.92	1.46	18.01	19.42	1.41
Age 22 to Age 52	26.38	27.13	0.75	26.65	27.13	0.48
Age 52 to Age 72	15.42	15.77	0.35	15.88	16.13	0.25
Age 72 to Death	8.11	8.17	0.06	8.64	8.66	0.02

Indiana

In Age Interval	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth to Age 22	18.23	19.24	1.01	18.58	19.68	1.10
Age 22 to Age 52	27.12	27.47	0.35	26.56	26.98	0.42
Age 52 to Age 72	16.30	16.57	0.27	16.53	16.72	0.19
Age 72 to Death	8.31	8.58	0.27	8.58	8.47	—0.11

Michigan

In Age Interval	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth to Age 22	18.34	18.87	0.53	18.89	19.36	0.47
Age 22 to Age 52	27.35	27.38	0.03	27.00	26.90	—0.10
Age 52 to Age 72	16.35	16.31	—0.04	16.61	16.45	—0.16
Age 72 to Death	8.35	8.31	—0.04	8.77	8.47	—0.30

New York City

In Age Interval	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth to Age 22	16.36	18.83	2.47	17.01	19.34	2.33
Age 22 to Age 52	24.99	26.81	1.82	25.97	27.08	1.11
Age 52 to Age 72	13.58	14.68	1.10	14.44	15.41	0.97
Age 72 to Death	7.09	7.67	0.58	7.61	8.26	0.65

TABLE A—Continued

Boston

In Age Interval	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth to Age 22	16.41	18.40	1.99	17.02	18.98	1.96
Age 22 to Age 52	25.37	26.82	1.45	26.01	26.70	0.69
Age 52 to Age 72	13.99	14.86	0.87	14.74	15.56	0.82
Age 72 to Death	7.35	7.50	0.15	7.90	8.44	0.54

Chicago

In Age Interval	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth to Age 22	17.65	18.60	0.95	18.23	19.22	0.99
Age 22 to Age 52	26.14	27.18	1.04	26.78	27.21	0.43
Age 52 to Age 72	14.33	15.20	0.87	15:39	15.84	0.45
Age 72 to Death	7.19	8.22	1.03	8.29	8.65	0.36

TABLE B

Complete Expectation of Life at Selected Ages

Massachusetts

Complete Expectation of Life At Age	*Males*			*Females*		
	IN 1890 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1890 YEARS	IN 1920 YEARS	GAIN YEARS
Birth	42.50	54.07	11.57	44.46	56.56	12.10
22	39.30	42.93	3.63	40.66	43.91	3.25
52	19.44	19.74	0.30	20.74	20.85	0.11
72	8.42	8.02	—0.40	9.18	8.61	—0.57

Original Registration States

At Age	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth	47.88	54.05	6.17	50.70	56.41	5.71
22	40.55	42.69	2.14	42.11	43.59	1.48
52	19.35	19.91	0.56	20.43	20.79	0.36
72	8.11	8.17	0.06	8.64	8.66	0.02

Indiana

At Age	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth	52.62	56.91	4.29	52.91	57.55	4.64
22	43.66	44.97	1.31	43.07	44.21	1.14
52	20.87	21.49	0.62	21.50	21.76	0.26
72	8.31	8.58	0.27	8.58	8.47	—0.11

Michigan

At Age	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth	53.45	55.12	1.67	55.07	56.01	0.94
22	44.20	44.24	0.04	44.18	43.59	—0.59
52	20.97	20.90	—0.07	21.72	21.28	—0.44
72	8.35	8.31	—0.04	8.77	8.47	—0.30

New York City

At Age	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS	IN 1901 YEARS	IN 1920 YEARS	GAIN YEARS
Birth	40.65	51.61	10.96	44.86	54.83	9.97
22	34.90	40.10	5.20	38.15	42.07	3.92
52	16.01	17.86	1.85	17.51	19.24	1.73
72	7.09	7.67	0.58	7.61	8.26	0.65

TABLE B—Continued

Boston

At Age	IN 1901	IN 1920	GAIN	IN 1901	IN 1920	GAIN
	YEARS	YEARS	YEARS	YEARS	YEARS	YEARS
Birth	41.64	50.56	8.92	45.14	53.31	8.17
22	36.34	40.22	3.88	38.75	41.55	2.80
52	16.67	18.04	1.37	18.08	19.64	1.56
72	7.35	7.50	0.15	7.90	8.44	0.54

Chicago

At Age	IN 1901	IN 1920	GAIN	IN 1901	IN 1920	GAIN
	YEARS	YEARS	YEARS	YEARS	YEARS	YEARS
Birth	46.31	52.36	6.05	50.79	55.49	4.70
22	37.97	41.78	3.81	41.38	43.27	1.89
52	17.13	18.98	1.85	19.35	20.27	0.92
72	7.19	8.22	1.03	8.29	8.65	0.36

THE IMMORTALITY OF ANIMAL TISSUES AND ITS SIGNIFICANCE

ALEXIS CARREL, M.D., The Rockefeller Institute for Medical Research

The body, as is well known, consists of myriads of cells organized as a harmonious whole. Since these cells are submitted to the rules of a disciplined community, they cannot display all their possible activities. Most of their potentialities remain virtual in normal life. It is during the development of pathological processes that they become actual. They are doubtless responsible for a number of important phenomena, such as inflammation, malignant tumors, wound healing, etc.

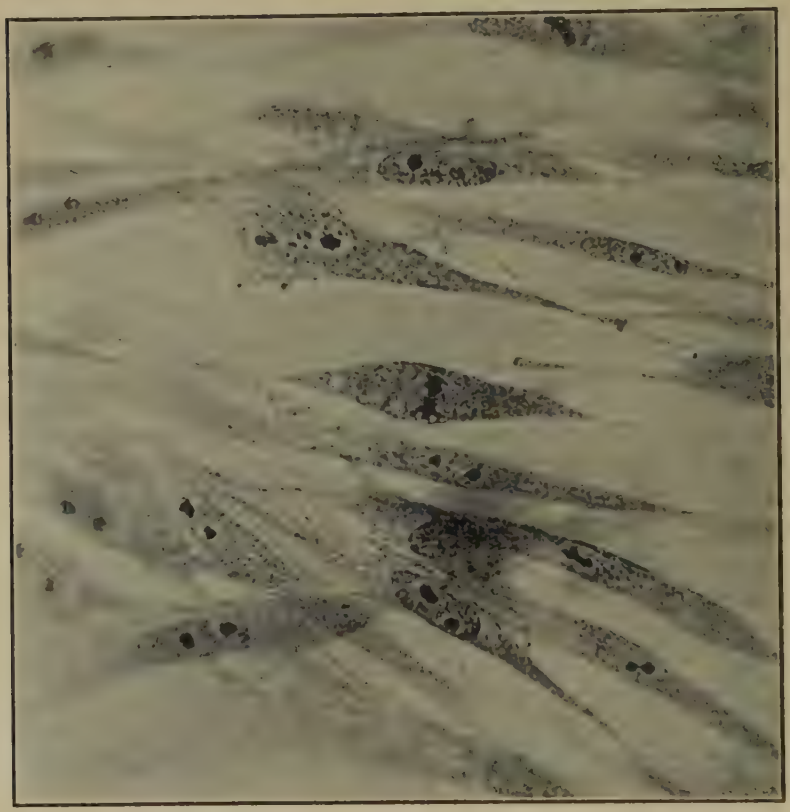
This train of thought led me, more than sixteen years ago, to study the hidden powers of animal tissues. The surgical methods that I used at the beginning of this investigation soon proved to be inadequate. Fortunately, Harrison published at this time his well-known experiments on the survival *in vitro* of fragments of frog embryos, and demonstrated that tissue cells completely separated from the organism could multiply for a few days. His work was the starting point of the elaborate procedures that I have developed for obtaining pure strains of various cell types, cultivating them in media of known chemical composition, measuring their rate of growth, etc. Through these methods, it became possible to observe under ideal conditions the fate of animal tissues when they are liberated from the restraint of the body.

The first experiment that gave a decisive result was undertaken on January 17, 1912. Several minute fragments from the heart of a chick embryo were cultivated according to a technique similar to that of Harrison. The bits of tissue went on pulsating, and surrounded themselves with connective tissue cells. But after a few days, pulsations and cell migration ceased. Degeneration was imminent.

DEATH OF TISSUE PREVENTED BY REMOVAL OF WASTE PRODUCTS

An attempt was then made to prevent death by removing the waste products from the cultures. For this purpose, the tissues were thoroughly washed, by placing them in a saline solution, and transferred into a fresh medium. Immediately, the heart tissue began pulsating again, and the cells migrated. This treatment was repeated every few days, and the little heart fragments continued living and beating. They did not, however, increase in size. On the contrary, they progressively diminished and faded away, or were killed by bacterial infection. Only one extremely minute fragment of heart remained alive and pulsating. But it was much smaller than a pin head, and could not

have failed to disappear within a few days. Then, a drop of embryonic tissue juice was added to the medium. A truly wonderful effect was immediately observed. Fibroblasts began to multiply about the tiny pulsating heart muscle, which was soon surrounded by a large amount of tissue in which it disappeared. The tissues went on growing and could be divided into two parts, which also grew rapidly. Every forty-



Pure Strain of Fibroblasts, 13 Years Old
(This photograph was made on April twenty-eighth, 1925.)

eight hours the cultures were washed in Ringer solution by Ebeling or myself, divided into two parts, and cultivated again in embryonic juice. Today, hundreds of experiments are made every month with the pure strain of fibroblasts descended from the tiny fragment of pulsating tissue that I possessed in 1912.

The colonies are cultivated in flasks with an oblique neck, which protects them from bacterial infection. They grow in a solid medium composed of diluted plasma. This medium is frequently washed in Tyrode solution. On its surface, some embryo juice or other sub-

stances used as a nutrient medium are injected every two or three days. The rate of growth is ascertained by the increase of the area and volume of the colonies.

AN EXAMPLE OF ETERNAL YOUTH

We are entitled to consider the experiment as almost concluded, as it has lasted for a period of sixteen years, while the duration of the life of a fowl rarely exceeds ten years. Two important facts have been brought to light:

1. The fibroblasts derived from the original heart fragment manufacture large quantities of new tissue from the substances contained in the culture medium. In forty-eight hours, each cell of a colony seems to divide twice, and the colony doubles in volume. Had it been possible to keep all the cells that could have been produced during these sixteen years, their mass would be immense. A colony originally one cubic millimeter in volume would produce approximately one cubic centimeter of tissue in about twenty days. After sixty days, the volume of the tissue would be a little more than one cubic meter, and in less than one hundred days, one million cubic meters. It is obvious that tissues growing at this rate for sixteen years would reach a volume greater than that of the solar system.

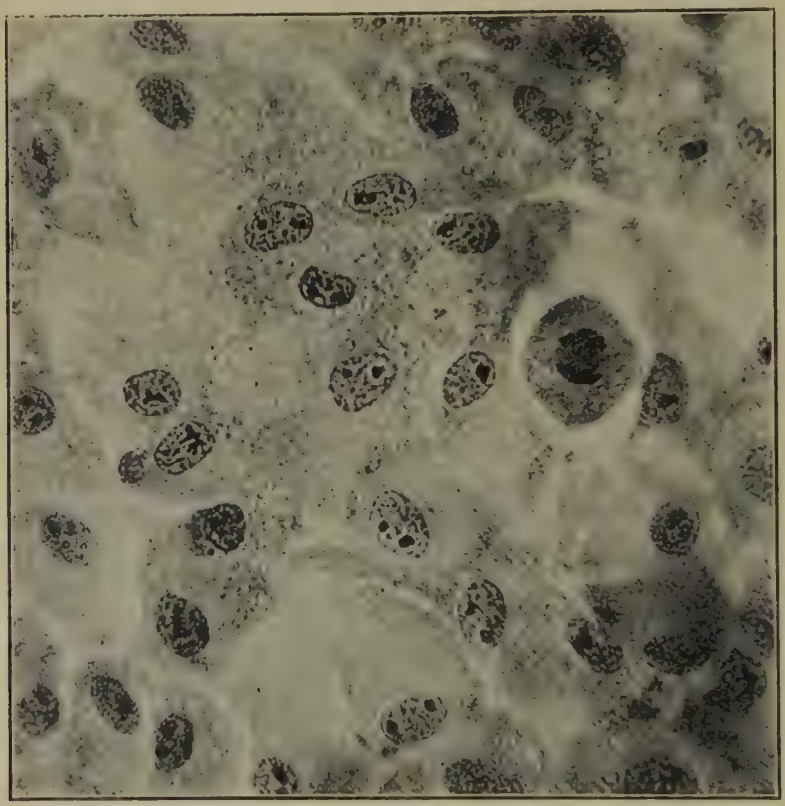
2. Cell proliferation is unlimited by time. Today, the rate of growth of the strain of fibroblasts is as great as it was fifteen years ago. The curve representing the variations of the growth velocity during this long period is parallel to the time axis. Time has no action whatever on these tissues. They are immortal.

This property also belongs to other tissues, as was shown by Fischer for iris epithelium, and by Ebeling for thyroid epithelium. Cultures of such tissues have been kept in full activity for several years in my laboratory. Normal and malignant cells of rats, mice, guinea pigs, and human beings were also discovered to be potentially immortal. Although the constituent cells of certain organs, such as brains, lived *in vitro* only for a short period of time, animal tissues in general must be considered as capable of unlimited proliferation, in time as well as in space.

These facts are of profound significance. They demonstrate not only that tissue cells are endowed with potentialities far greater than they display within the body, but also that those potentialities become actual under definite conditions, such as the elimination of certain metabolic products and the presence of proper nitrogenous food.

WHY THE TISSUES ARE HELD IN CHECK

It is obvious that the immense capacity for growth possessed by tissue cells must be kept under restraint while these cells live as parts of the organism. If the tissues of an adult animal suddenly were allowed to multiply freely, the body would grow in a rapid and disordered manner, and death would soon occur. Active proliferation of its con-



PURE STRAIN OF THYROID CELLS, 13TH PASSAGE

(This photograph was made on April twenty-eighth, 1925. The magnification in each case is 1,000.)

stituent cells would at once stop the functions of any gland. It is easy to imagine what would become of our memory and personality if the pyramidal cells started to multiply and to disturb the infinite complexity of the association fibers of the cerebral centers. Normal life and anarchical tissue growth are incompatible.

The mechanism that causes tissues to be comparatively at rest when they live within the body became less obscure after some fundamental properties of these cells were discovered. We found that, if fibroblasts

and epithelium are given certain nitrogenous substances, they are compelled to multiply. The substances endowed with the marvelous property of determining cell proliferation are embryonic proteins, and polypeptids resulting from the digestion of a number of proteins. It is the concentration of such substances in the medium that regulates growth energy. On the contrary, cell multiplication is inhibited by blood serum. This effect increases gradually with the age of the animal. The substances responsible for this phenomenon are lipoids, as was shown by Baker and myself. In the light of this new knowledge, it becomes entirely probable that the resting condition of adult tissues depends on the composition of the humors in which they are immersed. The cells are like a motor that stops when the fuel is exhausted and starts again as soon as the combustible is replenished. When inert fibroblasts are extirpated from an old animal and cultivated *in vitro,* they do not display any growth energy. But as soon as they are given embryonic proteins, they multiply again. The factors that prevent tissue cells from manifesting their potentialities during normal life are chiefly a scanty food supply and an inhibiting medium.

The actualization of these potentialities takes place only under the influence of pathological processes, such as skin regeneration, bone repair, or growth of a cancer. If tissue cells were not potentially immortal, there would be no cancer. Also surgery would be impossible Wound healing and tumor formation depend entirely on the capacity of adult cells to recuperate their embryonic proliferative activity. In the repair of a wound, leucocytes attracted to the site of injury manufacture directly or indirectly the substances that determine the multiplication of fibroblasts and epithelial cells. If they are prevented from coming, no cicatrization takes place. The growth of cancer is due to the special properties of malignant cells. These cells have the power, through the secretion of proteolytic ferments and acid formation, of producing substances that automatically compel them to multiply in an unlimited manner. In most of the cases, a resumption of cell activity within the adult organism must be attributed to the presence in the tissues of embryonic proteins or of polypeptids.

DEATH THE PRICE WE PAY FOR POSSESSION OF OUR BRAINS

Although the body is composed of elements that are potentially immortal, it is, and will always be, subject to senility and death. Cells living as parts of an organized community do not find in such an environment the conditions required for immortality. The only living forms enjoying eternal youth are the colonies of unicellular organisms that eliminate their metabolic products directly into the outside world.

When an animal is composed of a mass of cells organized as a closed system, the process of aging necessarily takes place. Immortality is incompatible with organization. But organization is necessary for the development of a highly differentiated nervous system and for the appearance of mental processes. Death is the price we have to pay for the possession of our brains. This price is not excessive, because the mysterious energy that is created by the cerebral cells, or expresses itself through them, is after all the greatest marvel of this Universe.

In spite of the fact that higher animals will never reach immortality, there is some hope that the duration of their life may be artificially increased. The solution of this problem, as well as of the far more important one of improving the quality of living beings, rests on the future progress of cell physiology and of the chemistry of nutrition. It is for this reason that I have considered it appropriate to lay before the members of this Conference the results obtained by one of the most powerful methods created for the investigation of cell functions. Through these experiments, the immortality of animal tissues, and some of their fundamental properties, have been revealed to us. For the present, these findings are only of theoretical interest. But we know, as Claude Bernard has aptly said, that the knowledge of nature always leads to its mastery.

HABITS IN RELATION TO LONGEVITY

Dr. John Harvey Kellogg, Medical Director Battle Creek Sanitarium; President Race Betterment Foundation

That man is naturally a long-lived animal is an undisputed biologic fact. Like his forest relative, the gorilla, he is an old-fashioned animal whose forebears roamed the earth with such other old-fashioned creatures as the elephant and the hippopotamus, in remote prehistoric times when Europe and America were covered with great forests of nut trees, which were later swept away by the devastating glaciers of the Ice Age.

If, as the zoologists tell us, an animal lives five times as long as is required for the attainment of adult development, man ought to live at least 100 or 120 years. The late Sir Lauder Brunton, one of the most eminent medical men of the last half century, maintained that man ought to live at least a century. That it is possible for him to do so is proved by the fact that there are living in this country at the present time more than 3,000 persons who are 100 years old or older, and more than 10,000 persons who are beyond the age of 95.

The question naturally arises, if three persons in a hundred thousand attain the age of 100 years, why do the other 99,997 persons not attain the same age? This question has within recent years been much discussed among scientists and some most interesting conclusions have been reached.

Dr. Irving Fisher, of Yale University, and Professor Hornell Hart, of Bryn Mawr College, are convinced by a study of statistics that the average length of life ought not to be less than 100 years, and Doctor Hart even suggests that in the year 2000 babies will be born who will live to the age of 200 years. This prediction is based upon the fact that within the last two centuries there has been a steady increase in the average length of life. Within the last century the average span of life has nearly doubled. At the same rate of increase the average age at death by the end of the century would be 100 years instead of the present 58 years.

INCREASE OF AVERAGE LONGEVITY NOT AN INDICATION OF INCREASED RACIAL STAMINA

This optimistic outlook is, however, clouded by the fact that the increase in the years of life has not been equally distributed over all ages, but has instead been most pronounced in the earlier years of life, while in advanced years, 80 and beyond, there has been no increase but an actual diminution in life expectancy.

As a matter of fact, therefore, the increase in the average length of human life cannot be regarded as an indication that the vitality or stamina of the human race is increasing in America, but rather as an indication that through public health measures and better protection we are lengthening the lives of feeble individuals, chiefly infants and children, who otherwise would have succumbed, thus increasing the average number of years lived but not increasing the maximum span of life. The number of centenarians living in the United States at the present time with a population of more than one hundred millions is only 3,000, whereas, in 1880, when the population of the United States was only fifty millions, the census showed the number of persons living in the United States 100 years of age or more to be over 4,000. In other words there were living in the United States in 1880 nearly three times as many centenarians per million as are living today. This is perhaps one reason why each census report shows a smaller number of persons as having died of old age.

The number of persons who live long enough to die of old age is diminishing. This fact is only one item in the great mass of scientific evidence, which indicates that the human race is degenerating and is menaced with ultimate extinction. Indeed, not a few of the leading scientists who have given thought to this question are convinced that race decay is already advanced so far that there is no hope for recovery.

At the last International Eugenics Congress the eminent Professor Darwin, son of the late Charles Darwin, said with bowed head and a sad voice, "If our present civilization survives, and I fear it will not, it will have to be because the United States saves it." He saw no hope in any other part of the world. And Dr. C. B. Davenport said in an address at the opening session, "Of course we all know that the human race will ultimately perish." Certainly the menace of race decay is a black cloud hovering over the world.

If any progress is made in extending the span of human life, it will be achieved, not through means such as public health measures and other agencies that protect man from contact with destructive forces, but through the application of measures whereby his native stamina and resistance may be improved, thus gradually restoring to the race the primitive toughness of fiber and immunity to disease and senility possessed by our primitive progenitors but lost by modern man.

In his upward struggle out of savagery, man has gradually learned how to apply to the exigencies of daily life the precious knowledge accumulated by age-long experience through hundreds of generations. Far beyond any other animal, he possesses the power of adaptation to new and unusual conditions. The application of knowledge to human life, and the adaptation of habits and modes of living to changing con-

ditions, have enabled him to survive while most other races of animals that began their careers along with him have perished and are known only by their fossil remains found buried deep in the stratified rocks which record the prehistoric story of the world.

These nice adaptations of bodily structure and function to food, climate and every detail of environment, are the result of the reaction of the living organism to life conditions during long ages. They were developed and definitely determined and fixed during man's primitive state, when he shared with other creatures of the plain and forest the freedom and the hardships of a natural primitive life. These adjustments are not ephemeral or transitory; they are so fixed and determinate that they cannot be ignored without damage and ultimate destruction of the recalcitrant or unfortunate organism. The many thousands of extinct species of animals buried in the earth's crust afford tragic evidence of the immutability of biologic law.

To this capacity for accumulating and applying knowledge and for change and adaptation, man owes his ability to acquire culture, to establish *mores,* and thus to achieve what we call civilization. But the superior intelligence and versatility that have secured to us these priceless boons are also a source of danger, since knowledge may be misapplied and changes may be made not for better but for worse.

NEED OF PROPER ADJUSTMENT TO BIOLOGIC REQUIREMENT

The agencies which are working the destruction of the human race are identical with those which are lessening the maximum span of human life. Race improvement can be secured only by improvement of the individuals of whom it is composed. That this may be done, the writer firmly believes. If the human race perishes, it will be because man has failed to apply to himself the knowledge by which he has improved every plant and every animal which he has gathered from the forest and the plain and made subservient to his uses. Other races of the animal kingdom have perished because they were helpless to combat the influence of climatic and other environmental changes which were inimicable to their biologic makeup. Man, through his intelligence, may—through clothing, change of habitat and other means—escape the deteriorating effect of hostile forces and may set to work improving agencies by means of which he may not only escape injury from destructive agencies, but may lift himself to higher and higher levels of vigor and of individual and racial stamina.

Unfortunately the race has up to the present time allowed itself to drift. Habits have been formed by chance. Civilized man has allowed his fancy and his impulses to lead him into devious and dangerous ways. Instead of following the leadings of wise Nature, he has sought to com-

pel his body to adjust itself to conditions so little adapted to his biologic requirements that it is breaking down under the strain, and has formed habits that, through their perversions have increased instead of mitigated the baneful influence of the adverse influences that have destroyed other creatures, genera and species and that affect man along with other members of the animal kingdom.

PREHISTORIC MAN WAS HEALTHIER THAN MODERN MAN

There are many reasons for believing that prehistoric man in his primitive environment had a far more vigorous and resistant organism than man now possesses. Professor Moodie, of the University of Urbana, Illinois, has shown us that at an early period the animal kingdom was not subject to bacterial disease—not because bacteria did not exist, but because animal forms were so highly resistant that bacteria were impotent to do them harm. They were immune to the attacks of pathogenic organisms. There is also convincing evidence that the men of the Cro-Magnon race were larger and more vigorous than those of any existing race and their native intelligence may have been as great or greater.

WE MAY LEARN VALUABLE LESSONS FROM THE GORILLA

The gorilla, perhaps man's nearest relative in the animal kingdom, still enjoys the advantages of the natural environment which man shared with him in prehistoric times, and thus has escaped the damaging effect of civilization and is the real king of beasts. Possessing ten times the strength of man, he is able, without the aid of firearms or other weapons, to hold his own against the leopards and other blood-thirsty creatures that swarm in African forests, and to live—according to Akeley—to the age of a full century or more. The gorilla has followed instinct and so has adhered to the ancient habits by which he has maintained the fine adaptations and adjustments, acquired through long ages of evolutionary development, that make up the life program of every species of animals, each item of which has some biologic significance and hence cannot safely be ignored.

IS THE PRESENT AVERAGE THE "NATURAL" LIMIT TO HUMAN LIFE?

Professor Irving Fisher has clearly pointed out that there appears to be no natural arbitrary limit to the duration of life. The Mosaic standard of three score years and ten is so often overreached that it is manifestly without biologic significance. The body appears to be in respect to its durability like a watch or any other mechanism. The length of time it will last depends upon the care that is given it and the manner in which it is used. An automobile built to endure the wear and tear of a hundred thousand miles of travel, if run at the rate of a

thousand miles a year would last a hundred years. If driven at the rate of a thousand miles a day, it would be ready for the junk heap in a hundred days. Without adequate supplies of gas and oil and the guidance of a competent driver, the most sturdy motor car might end its career in the first ten miles. Every man is his own chauffeur. Food provides the fuel and lubrication. The uses and abuses to which the body machine is subjected are the factors which determine the span of its useful activity.

THE CHIEF AGENCIES THAT SHORTEN LIFE

For the purpose of this paper the causes of death may be divided into two classes: (1) External agencies such as accidents and hardships through which man is damaged by violence, starvation or other deprivation of life essentials, and (2) acute and chronic poisoning, which operate by slow or rapid destruction of the body mechanism.

It is not within the scope of this paper to undertake a detailed study of all the possible agencies whereby the span of human life is shortened, but rather to consider factors that influence life expectancy after the age of 50 or 60 years; in other words, to study especially the causes of premature senility as related to habits. It has been known for centuries that old age is associated with changes in the bodily structures, such as thickening and hardening of the arterial walls, obliteration of the blood vessels, and disappearance of glandular and other cells of special function, with an increase of connective tissue in such organs as the liver, kidneys and glands and even in the heart and other muscles as well as in the brain and spinal cord.

Metchnikoff was first to call attention to the fact that these changes are the result of the circulation in the blood stream of minute quantities of poisonous substances. The views of Metchnikoff, supported by the observations of Bouchard, afforded the first rational explanation of the degenerative changes that occur in the various bodily organs and that have long been recognized by pathologists. Metchnikoff's views at first were ridiculed and vigorously combated, especially by the Germans, but they have so fully been confirmed by numerous trained investigators that at the present time no one questions the destructive effect of toxins circulating in the blood and the cumulative effect of these toxins even when present in exceedingly minute quantities.

The association of senility with changes in the blood vessels had been known long before the causes of these changes were appreciated. The dictum of an eminent French authority, "A man is as old as his arteries," has come to be an axiom in classical medicine, but modern research has made clear that it is equally true that a man is as old as his liver, as old as his heart, as old as his kidneys, even as old as his

skin, quite as truly as that he is as old as his arteries. And all these degenerative changes are the result of toxins circulating in the blood. In acute infectious diseases, such as scarlet fever, measles, typhoid, smallpox, etc., the chief morbid manifestations characteristic of each individual disease are the result of the circulation throughout the body of poisonous substances produced by the invading parasitic organism, which constitutes the infective agent. During an attack of typhoid, smallpox or any other febrile infection, the body is flooded with toxins and the liver and kidneys are so enormously overtaxed that without doubt these organs, as well as many others in the body, are to an extent irreparably damaged in every case.

THE LONGEVITY OF THE VISCERA

The delicate mechanism of the kidneys, by which the poisons in the blood are recognized and removed, is possessed of the native ability to perform a certain amount of work, differing in each case according to hereditary endowment and other factors. The aggregate amount of work that a kidney can do is as definitely limited as is the life of a watch or a threshing machine. Each kidney consists of about two million individual cells, the so-called glomeruli, each of which is provided with a minute drainage tube through which the poisons which it separates from the blood, may be carried away to be discharged through the bladder as urine. The lifetime job of each one of these cells is to produce about one-half ounce of urine. Constant activity of a kidney cell day and night for three months is required to produce a single drop of urine. These facts give some idea of the extreme delicacy of the renal structures.

In the liver is found an equally marvelous mechanism for the destruction of poisons. The thyroid gland, suprarenal capsules and various other structures, even the blood itself, are delicately formed and highly sensitive mechanisms for protection of the body structures against poisons.

Each organ has its natural limitations. It can do a certain amount of work, and when that amount of work has been done, it is finished; it must cease to function. Fortunately, each one of these organs, like every other vital organ, is naturally endowed with a large reserve of working power. From numerous observations made, I am convinced that this vital reserve with which Nature endows every bodily organ is sufficient, if properly and economically used, to sustain the human mechanism for two centuries or more. Unfortunately, it is very rare indeed that the human machine has even half a chance to exhibit its full capacity, and probably never an opportunity to do its very best.

In the control of typhoid fever, smallpox, scarlet fever and other infectious fevers, the modern public health movement has not only increased the average length of life, by lowering the death rate, but has contributed something toward the promotion of maximum longevity by preventing the irreparable damages to the kidneys and liver that are the inevitable result of a grave attack of the infectious fevers which were formerly the largest contributors to the mortality lists. Pathologists and clinicians have long been convinced that in a very considerable proportion of the cases of Bright's disease that appear in adult life, the foundation of the disease was laid in an attack of scarlet fever or some other acute infection in early childhood.

If these poisons produced by parasitic organisms invading the body were the only source of destructive poisons capable of producing senile changes and shortening human life, the problem of life extension almost invariably would be a comparatively simple one, but there are other important sources of poisons with which the body has to deal. One of these, which is universally affecting every human being, is to be found in the normal products of bodily activity.

"NORMAL" BODY POISONS

The body may aptly be compared to a locomotive. It burns fuel and produces energy, smoke and ashes. The body utilizes food in the same way and with the same results. Food is fuel. It presents to the body in an available form energy that has been captured from the sunlight by the chlorophyl grains in green leaves, and has been stored up for use by plants themselves and by animals. Food is simply sunlight in cold storage. Physicists tell us that on every square yard of the earth's surface there falls continually on the average a stream of energy in the form of sunlight equivalent to one horse power. In utilizing this energy in the taking of food, the body is compelled to dispose of noxious by-products which are strictly analogous to the smoke and the ashes of the locomotive. Some of these by-products are volatile like those which escape through the smokestack of the locomotive. These volatile products, chiefly CO_2, escape through the lungs. Other by-products, which correspond to the ashes of the locomotive, are dissolved out from the working cells as fast as produced and carried in solution through the blood stream to the liver and kidneys. The liver transforms and destroys some of these poisons. The kidneys are the principal avenue through which these wastes escape.

Some of these wastes are alkaline, others acid. As a whole, the body wastes are predominantly acid. Every muscular movement, for example, results in the production of lactic acid. A sprinter produces lactic acid at the rate of half a pint a minute. This great production

of acid compels him to breathe rapidly in order to obtain the oxygen necessary for burning up the acid, which if allowed to accumulate would soon produce death. To facilitate the rapid destruction of acid and to assist in getting it out of the body as rapidly as possible, the blood and tissue fluids are slightly alkaline. This alkalinity, though very slight, is absolutely essential to life. A loss of blood alkalinity equivalent to the difference between distilled water and ordinary pipe water would result in instant death. The blood alkalinity is also necessary to enable the body to combat the bacteria that are constantly invading the blood stream. Lowered alkalinity, a condition known as acidosis, is a state of low resistance and invites infection.

Sansum and others hold that the excessive accumulation of acid products in the blood, a condition known as acidosis, causes irritation of the vessel walls, gives rise to high blood pressure and encourages hardening of the arteries and degeneration of the kidneys, or Bright's disease. This condition of the blood is indicated by abnormal acidity of the urine.

ACIDOSIS AN OLD AGE FACTOR

In the writer's opinion undue accumulation of these acid products is one of the most widespread and most deadly causes of premature senility. The association of high urinary acidity and Bright's disease has long been recognized. In clinical experience one frequently encounters cases in which the urine is 20 to 100 times as acid as it should be, and Sansum reports cases in which the urine was found to be a thousand times too acid. Kidney cells constantly bathed in such highly acid urine rapidly become old through overwork. They are required to perform in 25 or 30 years as much work as nature intended them to do in 200 years. It is this extra work required of the liver, kidneys and other vital organs that brings the body to the human junk heap at a time when it ought to be at its maximum of efficiency and usefulness.

A simple experiment clearly shows the highly toxic character of these tissue poisons. A frog's muscle removed from the body may be made to contract and lift a weight many times. After a while, however, it becomes fatigued and ceases to contract. If, now, the muscle is washed in water containing a little salt, it may within a minute be set to work again, and it will continue its activity as long as at first.

The marvelous work of Doctor Carrel, of the Rockefeller Institute, clearly has shown the overwhelming effects of these body toxins in impeding function and producing senility. By an ingenious technic, Doctor Carrel has succeeded in causing the tissues of a chicken's heart to grow and function outside of the body. He accomplishes this by cutting off a bit of the heart of an embryo chicken and planting it in a

vessel containing lymph from a very young chicken. The greatest care is taken to avoid infection by bacteria. When kept at body temperature the heart tissues continue to contract rhythmically, as though in the body of the chicken. After a few hours the contraction ceases because of the accumulation of tissue poisons in the lymph. If, then, the lymph is exchanged for fresh lymph, the action begins again.

Another interesting fact is of great significance. Doctor Carrel has observed that if instead of lymph from a very young chicken he employs lymph from an older bird, the heart tissues soon stop beating, cease to grow and die. To keep the heart tissues beating and growing, under such extraordinary circumstances, requires the vigor and purity of young chicken blood. A chicken a year old is relatively as aged as a man of 30 or 40 years.

It is evident, then, that anything which increases to an abnormal degree these tissue poisons, which are known as urea, uric acid, creatin, creatinin, etc., must tend to wear out the organism prematurely and so to shorten life.

EFFECT OF EXERCISE ON TISSUE POISONS AND BLOOD ALKALINITY

Our habits have a very profound influence upon the production and elimination of these tissue poisons. While muscular exercise produces an increase of lactic acid, at the same time it so greatly increases the activity of the heart and lungs that within an hour or two afterward the tissues are found freer from acid-forming poisons than before the exercise was taken; that is, it increases the alkalinity of the blood and tissue fluids. This it accomplishes by increasing the amount of oxygen taken into the body as well as the storage of oxygen in the tissues. Lack of exercise, on the other hand, encourages the accumulation of waste products or tissue poisons.

An illustration of this is well shown in the case of the sedentary horse. A horse that has been allowed to stand for some weeks in the stable without exercise, when taken out and exercised with sufficient vigor to produce perspiration, after the moisture has evaporated, will have the appearance of being covered with frost, due to the waste material held in solution by the perspiration and left behind when it dries. If such a horse is exercised daily for a few days, the "frost" ceases to appear because the tissues have been washed free from the accumulated wastes. It will be noticed, also, that the perspiration of such a horse is limpid and odorless, wholly free from the strong odor of the perspiration shown at first.

When a sedentary man exercises so vigorously as to produce perspiration, his need of exercise will be emphasized by the strong odor that his skin exhales.

CENTENARIANS ARE GENERALLY PERSONS WHO HAVE BEEN PHYSICALLY ACTIVE

Old Parr, who is buried in Westminster Abbey and who was reputed to have died at the age of 152 years and 9 months, had been a man of great bodily strength and active physical habits during his entire lifetime. His age may have been somewhat exaggerated, but he was without a doubt a very old man, much above the century mark; and yet after his death, when his body was carefully examined by William Harvey, the discoverer of the circulation of the blood, not one hardened artery was found in his body. Centenarians are practically without exception persons who have been physically active either through earning their livelihood by some laborious occupation or by habitually taking vigorous muscular exercise.

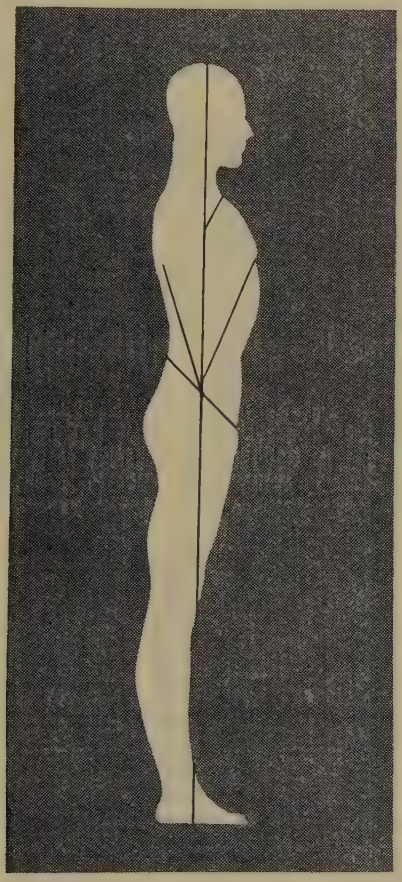
BAD POSTURE PROMOTES PREMATURE SENILITY

So simple a matter as habitual posture may have a very profound influence upon health and longevity. The blood vessels of the body may roughly be divided into three great vascular systems, one of which supplies the skin, another the muscles, and another the large viscera of the abdomen. The blood vessels of the muscles are capable of holding half of all the blood in the body. Those of the skin when fully dilated may contain two-thirds of all the blood in the body. The great vessels of the abdomen when fully distended are capable of holding all the blood in the body. The abdominal vessels are of course never fully filled. If they were, life instantly would cease, since the heart, brain and other vital organs can act only when an adequate blood supply is maintained.

To prevent the abdominal vessels from accumulating an excessive quantity of blood, Nature maintains what is known as intra-abdominal tension; that is, a certain degree of pressure within the abdominal cavity, which is kept up by the tension of the abdominal muscles that during life are normally always in a state of contraction. This tension enables these muscles to take up a considerable amount of slack, but not an indefinite amount. When the body is bent forward, the muscles may be relaxed to such an extent that the intra-abdominal pressure upon the blood vessels is entirely removed, but at the same time the folding of the body may mechanically compress the abdomen so that no harm results. When lying in the horizontal position, the tension of the abdominal muscles is lessened, for in this position gravity prevents an abnormal accumulation of blood in the abdomen. When the body is in the vertical position, however, it is necessary that these abdominal muscles should be constantly contracted in order to maintain

the necessary pressure and thus to prevent overfilling of the abdominal blood vessels.

An experiment made by Dr. Leonard Hill, of England, clearly showed the great importance of this function of the abdominal mus-



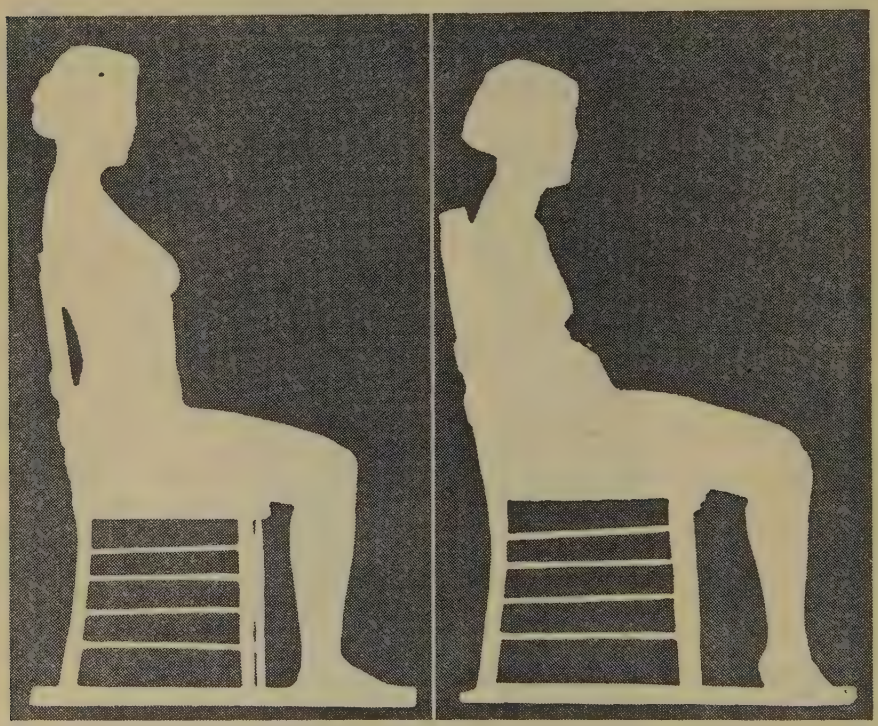
HEALTH, VIGOR AND SELF-RESPECT

Note the high-standing chest, the erect carriage of the head, the position of the hips and the curve of the small of the back.

cles. He suspended a rabbit in a vertical position, its head upwards. In a few hours the animal was dead, and the cause of death was found to be the accumulation of blood in the animal's abdomen, because its abdominal muscles were not strong enough to exercise the increased pressure upon the abdominal blood vessels necessitated by the vertical position, since the animal is accustomed to carry its trunk in the horizontal position. The same experiment was then repeated with a wild rabbit, whose abdominal muscles were tense and strong as the result

of the vigorous exercise required to keep out of the reach of hunting hounds. In this case the rabbit did not die, and appeared to suffer no injury from its vertical position, even though its suspension was continued many hours longer than the tame rabbit whose muscles had been weakened by its protected life in a pen.

Every business or professional man and every woman who spends many hours daily in the sitting position or in any other sedentary vo-



Shadowgraph of Correct and Incorrect Sitting Postures

cation, and neglects to compensate for this inactivity by such exercise as will develop the muscles of the trunk, will suffer the sort of injury inflicted upon the tame rabbit. If the results are not so immediately apparent, they will develop later in a lessened life expectancy. The bad effects of prolonged inactivity in the sitting posture are greatly exaggerated by a slumped or completely relaxed attitude in which the back is rounded, the chest flattened and the abdomen made abnormally prominent. In this position the action of the heart and lungs is greatly interfered with so that the blood is not properly aerated and the tissues not adequately supplied with oxygen. Tissue poisons then accumulate.

But the greatest injury is done to the abdominal viscera. Because of this slumped position and diminished movement of the chest, the blood stagnates in the abdominal region. The liver, stomach, kidneys and all other abdominal organs are overdistended with blood. One common result of this is the production of constipation and hemorrhoids, rectal fissure, fistula and other allied disorders.

Eminent clinicians have recently called attention to the fact that this relaxed or slouched posture, shown in the accompanying shadowgraph, is a potent cause of Bright's disease. The excessive accumulation of deficiently aerated blood in the kidney structures may lead to the appearance of albumin and casts in the urine. This is particularly likely to appear in feeble persons with a weak pulse and low blood pressure. In some cases such persons cannot assume the erect posture without the appearance of albumin in the urine. The amount of albumin is slight in the forenoon but increases in the afternoon. Jehle has observed a relation between cases of this sort and lordosis. I have noted a very great improvement in health and vigor in a large number of cases by simply correcting the patient's posture.

The following is a fair illustration of a great number of similar cases that might be cited: Many years ago, I was consulted by a well-known professor in an eastern university with reference to a condition concerning which he had consulted numerous eminent medical men without benefit. Though less than 40 years of age and well nourished, the professor found himself in a state of chronic fatigue. He was unable to work more than two hours a day. His physical endurance was so small that he was unable to walk more than a mile. As the professor sat in his chair, his posture was that of the usual college or professional man who does much reading. His back described an arc of a circle, his chest was flat, his abdomen protruding. His vest was wrinkled in many folds. I directed attention to the vest and to the fact that the skin underneath was also wrinkled, and endeavored to make clear to him that the accumulation of blood in his abdomen robbed his brain of blood that it needed to support active mental work. I showed him how to sit erect, and gave him a few exercises for strengthening his abdominal muscles. In a week he was feeling better. In three weeks he was notably stronger. In three months he was able to do as much work as at any time in his life. At the end of a year he was doing much more work than he had ever before been able to do, and was enjoying robust health, as he has since continued to do for more than twenty years. Although he made other changes in his habits of life that undoubtedly were of benefit to him, the professor has often said to me that he believes he has received more benefit from the correction

of his posture and exercises for strengthening the abdominal muscles than from any other change in his mode of life.

After an extended study of posture during more than forty years, I succeeded in devising a simple method of accurately determining and recording postural defects by means of which it is possible to establish postural standards on a more exact and definite basis than heretofore.

The first step in this method is to make a shadowgraph of the subject. This is simply a photograph of the shadow of the subject, who stands close to the screen on the side opposite the camera. The shadow is produced by a strong electric light placed at the distance of about twenty feet.

Markers are placed upon the surface of the body by means of which it is possible to draw upon the shadowgraph lines of reference which show at once the degree of deviation from the normal. A line indicating the obliquity of the pelvis is made the base of measurements. Through the center of this line a vertical line is erected, and from the point of intersection lines are drawn to the lower end of the sternum, the most anterior point of the body when in normal posture, and to a point on the spine opposite and at the same level.

The shadowgraph thus prepared shows at once the nature of the postural defect, and by measuring the several angles, the degree of departure from the normal may readily be measured.

A fact of major interest brought out by this mode of studying posture is that the greater part of the chest is normally carried anterior to the vertical axis of the body. This high carriage of the chest is necessary for the proper functioning of the heart and the diaphragm. When the chest is collapsed so that the anterior chest ratio is less than 100, the diaphragm and the viscera attached at its under side are forced down. The heart, which is attached by the pericardium to the upper surface of the diaphragm, is dragged down into a more or less vertical position, and in its beating is obliged to lift against this abnormal strain. In this way, an enormous amount of heart energy is wasted, and for this reason a flat-chested person is possessed of little endurance, and there can be no doubt that a heart compelled to work constantly under this grave handicap must succumb to the increased wear and tear to which it is subjected.

The accompanying cuts will give something of an idea of the degree in which the body is deformed and hampered by incorrect postures in standing and sitting and show the writer's method of studying postural defects.

HOW GLUTTONY KILLS

Of all faulty habits, that of overeating is, perhaps, the most common. Gluttony has always been the favorite vice of the well-to-do. According to Holy Writ, the "sin of Sodom was fullness of bread and abundance of idleness." An excess of fuel will smother the fire of a furnace. The clouds of black smoke that roll out of a chimney are visible evidence of incomplete combustion, which is filling the flues with soot and lessening efficiency. Food is body fuel. An habitual excessive intake of food produces identical effects in the body. The blood and tissue fluids are flooded with the toxic products of incomplete combustion quite analogous to the smoke from a choked furnace. A portion of the surplus food may be deposited as fat, but other portions, especially the protein, must be carried off through the kidneys at once, as there is no provision made for the storage of protein.

So there is a physiologic foundation for the homily, "Many people dig their graves with their teeth," since the extra work required of the liver and kidneys only serves to wear out the machine prematurely without any compensating advantage whatever.

EXCESS OF PROTEIN LEADS TO KIDNEY CHANGES

In the latest standard work on medical practice, "A Textbook of Medicine," edited by Prof. Russell L. Cecil, of Cornell University and Bellevue Hospital, we find the statement, "Recent experimental studies indicate that a high protein diet causes chronic nephritis."

The experimental studies above referred to doubtless include the extended investigations of Professor Newburgh, of the University of Michigan, who has carefully conducted studies of the effect of a high protein diet, and has shown that even as small a portion of meat protein as twenty per cent invariably leads to the premature development of arterial changes and degeneration of the kidneys in laboratory animals.

MUSCLE PROTEIN CAUSES NEPHRITIS IN RATS

Doctor Newburgh has extended his studies to an investigation of the effects of protein from different sources, such as plant protein, milk protein and muscle protein. He finds muscle protein, that is, ordinary lean meat, far more toxic than protein from other sources.

The fact that Arctic explorers and other men, as well as the Eskimos, have lived for various periods on an exclusive meat diet, is no evidence that protein may be eaten with large excess without injury. Stefansson, whose experience has often been quoted in favor of a high protein diet, said to the writer two or three years ago, "I have demonstrated that a man can live on an exclusive meat diet, but I have not proved that he can live longer on such a diet or more efficiently, and, of course, the scientific argument favors the low protein diet."

Explorers like Hall, Peary and Stefansson have shown the possibility of living upon Eskimo fare for several years, but the effects have not been good. Hall died of apoplexy when he should have been in his prime. Peary died prematurely of cardiovascular renal disease. Of Hall, who was the first advocate of the Eskimo diet for the Arctic regions, Rear-Admiral Davis tells us: "For several weeks previous to sailing he was under medical treatment. We learn from a letter written by Mr. Joseph Cox, Presiding Judge of the Court of Common Pleas, Cincinnati, in which city Captain Hall enjoyed a short visit to his family before he sailed, that while in company with the Judge, going up Vine Street, near Sixth, he complained of suffering from vertigo, said that it troubled him frequently, and added that the only thing that gave him relief was eating one or two pounds of raw beefsteak; and bade me (the Judge) goodbye, saying that he must go to a butcher's shop and get some now to relieve him so that he might recruit and be ready to return to New York."

The sudden death of Shackleton, another Arctic explorer, may be regarded as another instance of sacrifice to a high protein diet. It may be recalled, also, that Atwater, an advocate of the high protein diet, also died of apoplexy.

AN IMPRESSIVE LESSON FROM THE WORLD WAR

The ration of millions of people during the World War provided a gigantic experiment in human nutrition, and demonstrated not only that the free use of meat is not essential to health, but that a low protein ration is beneficial. In Germany and Denmark the beneficial effects of diet rations were particularly marked.

The medical director of one of the world's largest insurance companies said to the writer, "Notwithstanding the fatalities due to active warfare, the death rate among the company's policyholders in Continental Europe was very considerably less during the War than before it began. In Denmark, the mortality rate was reduced one-third, and the reduction of the morbidity rate was still more pronounced. Diabetes, obesity, gout and other disorders of nutrition nearly disappeared from the mortality tables. In this country and other countries the death rate has been lower since the War than before. This, in the writer's opinion, is largely due to the improvement in eating habits, resulting from rationing, and the education of the public in regard to foods and feeding, by means of lectures, demonstrations, movies and other educational agencies conducted by the Red Cross and other organizations during the War.

The diet of all civilized nations, as the result of education and restriction, was modified in a variety of ways in the direction of sim-

plicity and frugality, but by far the most important modification was the lessened meat consumption. The Inter-Allied Scientific Food Commission at a meeting during the War, in preparing a list of essential foodstuffs, omitted meat from the list, formally declaring flesh foods to be non-essential, a conclusion that was strictly in accord with the recognized data of human physiology and the attested facts of human experience.

EARLY PREHISTORIC MAN NOT A MEAT FEEDER

Elliot, of Oxford, in his great work, "Prehistoric Man," tells us:

"There was not, so far as we are aware, any carnivorous creature in the Eocene Period, or one that might have been a serious enemy (of man)."

According to Professor H. M. Ami, of Montreal, all paleontologists agree that man did not become a flesh eater until after the arrival of the Glacial Period, when the great forests of nut trees and wild fruits, which had previously constituted his chief food resources, were destroyed by the ice cap that crept down over the Northern Hemisphere and compelled those who did not migrate to the South to seek shelter in caves.

Giuffrida-Ruggeri, the eminent Italian anthropologist, and Sir Arthur Keith, the eminent English anatomist, agree that the teeth of the Heidelberg man—who, according to the geologists, died at least two hundred thousand years ago—clearly indicate that his diet was that attributed to him by the great French naturalist, Cuvier, viz., fruits, nuts, grains, tender shoots and succulent roots, and that it did not include flesh.

Says Henry S. Graves, of the United States Forest Service, in the *Mentor,* for June, 1918:

"To primitive man the forest furnished both food and a home. Later, when he had become a meat-eater, man left the forest for the treeless plains, where he found in abundance the animals upon which he preyed." Flesh-eating was, then, an acquired practice, which was the result of man's forced change from his original environment, where his natural foodstuffs were provided ready at hand in great abundance.

It is entirely possible that if all the early representatives of the human race had migrated to the South, as the chimpanzee, gorilla and other primates seem to have done, man might, like the latter, have adhered to the original bill of fare. In fact, the majority of dwellers in tropical regions are at the present day still users of meat only to a very limited degree. The per capita consumption of flesh foods even by the Japanese, who live in a comparatively cold climate, is only four pounds a year, or about one ounce a week.

It is evident that so far as man has become an eater of flesh, he has followed the example of degenerate and predatory beasts, creatures that are far removed from him in structure and wholly outside his biologic class, instead of following the example of his nearest relatives in the animal kingdom, members of the same biologic group, the wonderful primates, the most intelligent and most human-like of all existing animal forms.

The extreme dislike that some adults and most infants exhibit toward flesh food of any sort is attributed by Fitch to an "atavistic tendency," that is, the survival of the primitive instinct of our prehistoric non-flesh-eating ancestors.

THREE-FOURTHS OF WORLD'S POPULATION LOW PROTEIN FEEDERS

The human race in general has never really adopted flesh as a staple food. The Anglo-Saxons and a few savage tribes are about the only flesh-eating people. The people of other nations use meat only as a luxury or as an emergency diet. According to Mori, the Japanese peasant of the interior is almost an exclusive vegetarian. He eats fish once or twice a month and meat once or twice a year. Throughout the Island Empire, rice is largely used, together with buckwheat, barley, wheat and millet. Turnips and radishes, yams and sweet potatoes are used freely, also cucumbers, pumpkins and squashes. The soy bean is held in high esteem and used largely in the form of *miso,* a purée prepared from the bean and fermented; or *to-fu,* a sort of cheese; or *cho-yu,* which is prepared by mixing the pulverized beans with wheat flour, salt and water, and fermenting from one and a half to five years. The Chinese peasant lives on essentially the same diet, as do also the Siamese, the Koreans and most other Oriental peoples. Three-fourths of the world's population eat so little meat that it cannot be regarded as anything more than an incidental factor in their bill of fare.

Among primitive people, meat is often eaten for other reasons than the satisfaction of hunger. The Maori eats the flesh of a slaughtered enemy in order to become possessed of his courage and strength. The people of lower Nubia, in like manner, eat the fox with the idea that in so doing they may become possessed of his cunning. In upper Egypt the heart of the hoopoe bird is eaten to acquire the ability to become a clever scribe. The bird is caught and its heart is torn out and eaten while still alive.

That flesh food is not the natural diet of man is shown by the fact that it is seldom eaten in its raw state. Cookery seems to be more than a means of catering to the gustatory sense, for Laroche has shown

that raw meats contain poisons to which some persons are susceptible and which are destroyed by heat. This is another significant fact showing that meat is not naturally designed for human food, for cookery is not a part of Nature's biologic scheme. Hence the fact that man is able to eat and digest cooked meat is no more evidence that he is naturally carnivorous or omnivorous than the fact that he can eat and digest cooked corn is evidence that he is to be classed with graminivorous animals, like the horse and the ass, which are eaters of raw grains.

The bill of fare that wise Nature provides for man in forest and meadow, orchard and garden, a rich and varied menu, comprises more than 600 edible fruits, 100 cereals, 200 nuts and 300 vegetables—roots, stems, buds, leaves and flowers—to say nothing of eggs, milk and various other dairy products. Fruits and nuts, many vegetables—young shoots, succulent roots and fresh green leaves—and all dairy products, are furnished by Nature ready for man's use.

A notable difference between the flesh of animals and vegetable foodstuffs consists in the fact that all flesh foods contain a considerable proportion of waste and poisonous matters, which are the result of tissue work and which at the death of the animal are on their way to the liver, kidneys, colon and other excretory organs for elimination. In eating meat, one necessarily adds to the toxins produced by his own body those produced by the tissues of another animal, and thus imposes upon his kidneys a task that should have been performed by the kidneys of the slaughtered beast.

MEAT EXTRACTS CONTAIN TOXINS IN CONCENTRATION

The extract of meat contains a large variety of tissue poisons, among which are xanthins (uric acid), adenin, tyrosin and leucin, besides 10 or 12 per cent of creatin and creatinin, together with ignotine, novaine, carnitine, vitiatine, oblitine, carnic acid and numerous other waste products recently isolated by Kutscher.

Roger, the eminent pupil and successor of the famous Bouchard, says of meat extracts: "The toxicity of extracted matters is real. Extracts of meat contain 22 to 25 per cent of salts of potash and 10 to 15 per cent of extractive matters. Their ingestion, even in moderate doses, produces intestinal disturbances, notably diarrhea. Dogs fed with extracts of meat die more rapidly than dogs that receive nothing at all. A person in health may use extracts of meat in small quantities, but *it is necessary to prohibit meat extracts for invalids.*"

According to Gautier, *a quart of beef tea contains enough creatin to kill nine guinea pigs,* besides certain salts, purin bodies, and other substances even more toxic than creatin. When to this we add the fact

that the nutritive value of meat broths is practically nothing (according to Gautier only one calorie to the ounce), we find ample justification for the assertion of Legendre that bouillon is "a veritable solution of poisons," and the caution of Roger that meat broths and extracts should be wholly avoided by invalids. Meat extracts are particularly dangerous for persons suffering from Bright's disease, disease of the liver, arteriosclerosis, or exophthalmic goiter. If *dangerous* for invalids they certainly cannot be *wholesome* for anyone.

The meat extracts in general use are, if possible, still more objectionable than freshly prepared broths. Fully 20 per cent of these extracts consist of poisonous substances. So long ago as 1871, P. Muller observed that the addition of an ounce of meat extract to his daily diet produced diarrhea, an evident defensive effort. Two-thirds of an ounce of a good extract of beef added to the regular diet of a dog weighing 14 pounds produced diarrhea on the sixth day and death from collapse on the ninth.

Meat extracts of all sorts are concentrated preparations of the toxins of meat. They have no nutritive value, and their use cannot be too strongly condemned. Meat extracts are, according to Gautier, fifty times as toxic as broth made from two pounds of beef and five pints of water. The remnants and refuse from which meat extracts are made are always in a state of beginning decomposition and often well advanced in decay. In the extracts, the products of decomposition are found in concentrated form. This is the explanation of the putrid odor always noticeable in meat extracts.

UNWHOLESOMENESS OF VISCERA

The viscera of animals are the most objectionable form of flesh foods. All the viscera contain xanthin or uric acid in large amount. Gautier says of the spleen, "This flesh is only a very bad aliment." While the protein of all meats is more or less toxic, the protein of liver is highly objectionable. The kidneys of animals fed upon liver very soon become diseased.

A few years ago I had the pleasure of visiting in his laboratory an eminent bacteriologist, professor in one of the world's greatest universities. In the course of the conversation I remarked, for the purpose of eliciting an opinion from the professor: "A bacteriologist ought to oppose the use of meat, because every morsel is swarming with putrefactive organisms, Welch's bacillus and other pernicious germs that infect the alimentary canal, particularly the colon, and so become the cause of colitis, appendicitis and other diseases; besides producing virulent poisons that damage the liver, kidneys and other bodily structures in a great variety of ways."

"Yes," said the professor, "as meat comes from the butcher shop, as it is ordinarily eaten by people, it is filled with putrefactive bacteria. I entirely agree with you. *Meat is unnecessary as an article of food and is more or less harmful.*"

According to Weinzirl (*American Journal of Public Health*, 1914):

"The standard of 1,000,000 bacteria per gram, advocated by some as a limit, is apparently too low, since it would condemn nearly all samples of hamburger, when showing no taint or other evidence of putrefaction. *Samples of other market meats, all of which would otherwise pass inspection, often exceed this limit.* (There are 28.4 grams in an ounce.)

"A bacterial standard of 10,000,000 per gram is the limit proposed, on the basis of which 50 per cent of the market samples of hamburger would still be condemned. This is justified on the following grounds: (a) Much of it is actually spoiled when it reaches the consumer or is to be cooked; (b) meat teeming with 10,000,000 bacteria per gram is potentially rotten and soon will actually be spoiled under ordinary methods of handling; (c) the fact that markets are prone to add sodium sulphate to hamburger, even though the dealer knows it to be contrary to law, indicates that something is wrong with the hamburger; and (d) finally, if hamburger were made from wholesome meat in the first place, then properly iced, it is believed that the bacterial content could readily be held within the 10,000,000 limit."

PUTREFACTIVE BACTERIA IN MEAT

Another objection to meat as an article of food grows out of the fact that of all foodstuffs it most readily undergoes putrefactive changes, and as eaten is always more or less advanced in the process of decomposition.

Doctor Tissier made a study of meat, obtaining specimens from the butcher shops. He found every specimen swarming with the bacteria of putrefaction, the very same germs that are found in putrefying carcasses. Doctor Tissier then went to the slaughterhouse and obtained specimens of meat from the slaughtered animals as quickly as possible after the animal was killed. These pieces of flesh were put into test tubes and sealed up. Later, when the tubes were opened, the same putrefactive germs were found as were found in the specimens obtained from the meat shops, and the same as are found in the foul bowel discharges of cats, dogs and men who are eaters of flesh.

The source of the manure germs, with which butcher's meat always teems, is easily found. The bodies of cattle are always soiled with their excreta. In skinning them, the butcher's hands become soiled. After the skin is removed, the soiled hands of the butchers come in

contact with the warm, bare flesh, and the manure germs with which the meat is thus inoculated rapidly penetrate the whole body of the animal. Bacteriological examinations have shown that within a few hours after the animal is killed, every part of the carcass is swarming with the filthy germs found in its excreta.

To prevent this would require the same precautions that are taken in performing a serious surgical operation. It would be necessary to shave and disinfect the skin, to cover the butcher's hands with rubber gloves, and to keep the slaughter house as immaculately clean as a modern surgical operating room. But this is never done, and, according to the report of the United States Bureau of Animal Industry, one-third of all the meat eaten in this country has had no inspection.

THE "EAT MORE MEAT" CAMPAIGN A NATIONAL MENACE

In view of these facts, it is, to say the least, most regrettable that there should exist in this country a regularly organized body engaged in conducting a nation-wide campaign for the purpose of increasing the consumption of meat. Thousands of doctors are daily saying to their patients, "Eat less meat." The increasing prevalence of heart troubles, kidney troubles, gastric and duodenal ulcer, high blood pressure, arteriosclerosis and other diseases, such as those of the circulatory system, that are now the chief cause of death in this country, may be justly attributed, in part, at least, to the excessive intake of protein through meat-eating. The lives of thousands of persons have been prolonged by the timely advice of wise physicians to eliminate meat from their bills of fare. In face of these facts, the appeal of the Meat Board to the public to "Eat More Meat, to save the livestock industry," is nothing less than an insult to the intelligence of the American people and a menace to the public welfare.

This exploitation of popular ignorance is nothing less than a crime. The Meat Board, like the Cyclops of ancient story, through its publicity campaign of misinformation, annually engulfs in its capacious maw not only "fair maidens" but many thousands of fathers and mothers, young men and little children.

UNWHOLESOMENESS OF DENATURED FOODS

Another source of wholesale mischief to the physical welfare of the American people is the use of denatured foods. We no longer take our sustenance from the hand of Nature, gathering it at the cost of much physical exertion from forest and plain, hillside and valley, but receive it at the door from the hands of the grocer, the butcher, the miller, the baker and a hundred other purveyors of food and culinary accessories. Instead of taking our food supply in the natural

state in which it is furnished to us by Mother Earth, or made more acceptable by simple cooking processes, we require it to be sophisticated and in a multitude of ways to be denatured, even poisoned, by an army of caterers, cooks, confectioners and food adulterators, thus exposing our bodies to an indefinite number of damaging influences which our primitive ancestors escaped. A large proportion of the foods in common use that constitute the staples of American dietaries are woefully deficient in some of the elements essential for good nutrition. There is no lack of proteins, fats and carbohydrates, but an almost universal deficiency of vitamins, organic salts and roughage.

As McCarrison has pointed out, the lack of vitamin B, through the general use of fine flour bread and other decorticated foodstuffs, is doubtless largely responsible for the vast army of tired folks who swarm in factories, school rooms and offices, and support a drug store on every other corner in our cities, to supply them with "pick-me-ups" of various sorts, and harmful cola drinks for a kick to keep them going.

It is only necessary to witness the almost instant restoration to vigorous activity of a paralyzed, vitamin-starved rat by a minute quantity of a vegetable concentrate rich in vitamin B, to be convinced of the enormous injury done to millions by the almost universal deficiency of this essential food element in our dietaries. The same denaturing processes that rob our foodstuffs of their vitamins also deplete their mineral content, and thus deprive us of the iron and copper we need for blood building, and the lime we require to maintain the health of bones, blood, muscles and nerves.

IMPORTANCE OF GREENS IN MAINTAINING HEMOGLOBIN

Some years ago, at the first Chicago Health Exhibition, I conducted a health clinic and tested the blood of 6,000 persons, men, women and children. The average percentage of hemoglobin was found to be 80; 81 for males, and 79 for females. A sufficient number of cases showed 100 per cent hemoglobin to justify the correctness of the standard and the technic employed.

The American diet is deficient in greenstuffs and other foods rich in iron and also in copper, which has recently been shown to be as essential as iron for maintaining the normal per cent of hemoglobin.

For many years I have been able to maintain a hemoglobin percentage of 100, never below 99, and sometimes 102 or 103, by the use of spinach or greens of some sort every day, usually at two meals.

Among 100 poorly nourished school children, eight to twelve years of age, I found only 6 who ate greens, and then not every day but two

or three times a week. Spinach or greens of some sort should be considered an essential of the bill of fare. The Japanese and Chinese uniformly serve spinach with boiled rice, heaping upon the rice a little mountain of spinach, turnip leaves or some other one of the more than forty different kinds of greens of which Orientals make use.

As commonly used, cabbage and lettuce contribute comparatively little toward meeting the requirements for organic salts and vitamins, since it is the green parts of plants alone that are rich in these elements. Leaf lettuce should be used instead of head lettuce and cabbage. Greens and kale should be more freely used.

REGULAR AND FREQUENT BOWEL FUNCTION NECESSARY TO HEALTH

Another radical defect in our American bill of fare is a deficiency of roughage, the result of which is intestinal stagnation or stasis. The gorilla and other of the great apes in their native forests subsist upon a dietary so rich in cellulose and other indigestible elements that the evacuations are frequent and bulky. As described to me by Professor Akeley, who made a careful study of the gorilla in his native wilds, the stools of this manlike ape are bulky, soft rather than formed, having about the consistency of oatmeal mush when cold, and free from offensive odors.

The keepers of these large apes in zoological gardens find it necessary to regulate their diet in such a manner as to secure four to six bowel movements a day, in order to keep them in health. When the movements are less frequent, the animals become dumpish, lose their appetite, and are evidently ill.

Primitive people, savages, are very careful to maintain regular functions and move the bowels after each meal. This custom is universal among the Turks, who consider themselves ill and consult a physician whenever the bowels move less than three times a day (Shepard).

The time required for digestion and absorption of the digestible portions of the food has, in recent times, been shown to be much less than formerly supposed, the process being completed within eight hours. At the end of that time the indigestible and unused residues are found deposited in the colon. A few hours later they should reach the lower part of the colon ready for evacuation.

Hertz, of London, has shown that the act of eating greatly stimulates the activity of the colon, so that with proper encouragement, by the formation of correct bowel habits, the food residues and body wastes may be disposed of within fourteen to twenty-four hours after the food is eaten. When the bowels move but once a day, the residues are retained for fifty to ninety-six hours, or even more. When so long retained, food residues undergo putrefactive changes. This is

especially true of flesh foods, which putrefy in the warm interior of the body very actively. It has been shown that not less than one-seventh of the protein or lean meat eaten is destroyed by putrefaction.

Meat is the most highly putrefactive of all foods for the reason that it is always already in a state of putrefaction when eaten, often well advanced. The result of these putrefactive processes is the production of enormous quantities of toxic substances which when absorbed into the blood impose upon the liver and kidneys a prodigious task in preventing their accumulation in the blood stream to such an extent as to produce grave effects. So long as the kidneys and liver are able to perform their functions efficiently, no serious defects are experienced, but after a time they become less efficient. Then the toxins begin to accumulate and the result is the development of a great number of disorders which are recognized as the results of intestinal toxemia, or autointoxication. Headaches, nervous exhaustion, skin disorders of various sorts, so-called "biliousness," premature senility, hardening of the arteries, high blood pressure, even Bright's disease, and hardening or cirrhosis of the liver, possibly also cancer of the intestine, are among the dire effects of this form of chronic poisoning.

CONSTIPATION ESPECIALLY DANGEROUS TO MEAT-EATERS

The normal diet of man, that to which he is by nature adapted, and which is the diet of his nearest relatives in the animal world, the anthropoid apes, is laxative and antitoxic, and produces inoffensive residues; while the stools of mixed feeders, especially when meats are freely used and the bowels constipated, have the highly offensive character of the stools of carnivorous animals. Colons habitually filled with putrefying material are unquestionably a veritable Pandora's Box of physical ailments, and a potent cause of premature old age and lessened longevity.

Every person whose tongue is badly coated, whose breath is bad, who is constipated and whose stools have an offensive odor, is by these plain indications notified that his life is each day being shortened, not only by the steady march of old Father Time, but by the damage done to his body, which will ultimately result in a premature breakdown of his vital machine because of the onerous and unnecessary burden loaded upon his liver and kidneys through the absorption of poisons from his neglected colon.

Mineral waters and laxatives of all sorts are not satisfactory remedies for this condition for the reason that the constant irritation produced by these drugs results in colitis, which destroys the filtering power of the intestine and thus breaks down the defensive barrier which Nature has created for protection against intestinal toxins.

MORTALITY OF ALCOHOL USERS DOUBLE THAT OF ABSTAINERS

By no means the least important among the habits that threaten life are the various forms of drug addiction which civilized man has cultivated. The most ancient of these is the alcohol habit, which has been passed down to us from our prehistoric ancestors. This mysterious drug, which has held the world in bondage for centuries and filled our prisons, our almshouses, feeble minded institutions, and our insane asylums, is at last discredited, and is in a fair way to be eliminated from human society.

That the habitual use of alcohol shortens life has clearly been shown by the experience of life insurance societies in England. This is so well recognized that I do not think it necessary to recapitulate the evidence here. The most notable examples of longevity have rarely been alcohol users.

Hunter, the able actuary of the New York Life Insurance Company, showed some years ago that the mortality of alcohol users, even moderate drinkers, is double that of total abstainers.

THE INFLUENCE OF TOBACCO ON LONGEVITY

A question upon which there is less unanimity of opinion is, What is the effect of smoking upon longevity? It is universally admitted that an abnormal increase of blood pressure is highly unfavorable to longevity through an abnormal and wasteful increase of heart work. The amount of work done by the heart has by the researches of Richardson been found to be much greater than has previously been supposed. The volume of blood pumped by the heart, according to this observer, when the body is at rest, is about equal to the amount passed through the lungs. The work of the heart is, however, enormously increased by muscular activity, and amounts, on an average, to about 300-foot tons in twenty-four hours. The actual working time of the heart is only ten hours, since it rests fourteen out of the twenty-four, the aggregate of the short pauses between beats.

Few smokers are aware of the fact, to which Doctor Janeway called attention some years ago, that the smoking of a single cigar raises the blood pressure twenty points in thirty minutes; that this rise of blood pressure always occurs and is maintained while the smoking is continued, and is always followed later by a depression of the heart's action, for tobacco is fundamentally a depressing heart poison. It is for this reason that sprinters and long distance runners never smoke. In fact, the trainers of athletes practically always prohibit the use of tobacco in any form during a period of training.

Tobacco is a muscle poison and lessens the power of the heart to work while at the same time increasing the work required of it through

the contraction of the blood vessels. Says Norris, "Nicotine is, next to adrenalin, the most active of all drugs in causing contraction of the blood vessels."

The same authority adds that tobacco should be forbidden "when we wish to spare the heart." But why wait until these organs are upon the verge of collapse before beginning to conserve their energy? The physician who forbids his cardiovascular renal patient to smoke does not expect to effect a cure by his prescription, but only to postpone the funeral for a short period. Would it not be more rational to begin earlier and thus to eliminate the cause for the funeral?

The report of the Census Bureau shows that there are living in the United States at the present time 2,841 centenarians, of whom 974 are men and 1867 women, from which it appears that we have twice as many centenarian women as men.

According to the same authority, there are more women born in the United States than men. How then, does it happen that at one hundred years we have twice as many women alive as men? The best explanation I have been able to find for the fact that two women survive at one hundred years for every man is the difference in habits between the two sexes.

In general, men and women live under like conditions. They live in the same house and eat the same food. Of the two, men have a better chance to survive because of their better opportunity for outdoor activities. The greatest difference in habits is found in the fact that the use of alcohol and tobacco by women is small compared with the amount of these drugs consumed by men. A survey of the causes of death shows that many more men than women die of disease of the heart or arteries, a class of maladies that destroys many more lives than any other.

TOBACCO A POISON TO THE HEART AND BLOOD VESSELS

The use of tobacco was introduced into New England by that brilliant but unprincipled genius, Sir Walter Raleigh. Raleigh promoted the use of tobacco by most extravagant claims and wide advertising, the purpose being to create a market for his great tobacco farms in Virginia.

Through extensive advertising and other insidious means, the manufacturers of tobacco in this country have increased its use to such an extent that it has become a grave menace to the physical, mental and moral welfare of the American people, especially since its use by women has increased so rapidly in recent years. Undisputed scientific facts show that tobacco is a heart poison, a muscle poison and a nerve poison and greatly lessens accuracy and endurance, prevents proper develop-

ment of growing youth and lessens the birth rate; hence is a race poison as well as a damage to individual users. It would certainly be unreasonable to expect any increase in maximum longevity or in the number of persons who attain the age of 80 years or more as long as tobacco is as widely used as at the present time.

That tobacco exercises a particularly destructive effect upon the blood vessels has long been known. Boveri gave nicotine to rabbits for eighty-four days, and found hardening of the blood vessels. Extensive hardening of the arteries was found in a boy of seventeen who was a great cigaret smoker.

Tobacco causes temporary constriction of the blood vessels, with the pain and other agonizing symptoms characteristic of angina pectoris. Brooks states that these anginal pains sometimes appear with the first cigar, but usually develop later.

Kreuznach has pointed out that contraction of the vessels of the intestines and other abdominal organs, with extreme pain, may be due to the same cause.

The heart nerves do not become accustomed to the drug by use, but on the contrary become sensitized so that the poisonous effects are produced by smaller doses than at first. Brooks relates a case in which a heavy smoker had become so sensitized that he could not enter a room containing tobacco smoke without being seized with an anginal attack. He was of course compelled to cease smoking.

According to Huchard, the anginal attacks produced by tobacco have proved fatal.

It is a significant fact that while disease of the arteries has increased greatly in this country in recent years, no such increase has occurred in great Britain. Likewise, there has been no increase in the consumption of tobacco in Great Britain, where the annual average consumption remains at 4 pounds, while in this country the average has risen to the enormous figure of 7½ pounds per capita per annum.

With the male population only 3 per cent greater than that of females, the number of deaths from tuberculosis between the ages of 35 and 75 years is, for men, 22,997, and for women, 13,040; that is, 176 men die of tuberculosis for every 100 women.[1]

Some years ago, the writer received confidential information from a leading life insurance authority that at least two experienced life insurance experts were convinced that the mortality of smokers in general is at least 8 per cent greater than that of non-smokers.

In view of all this evidence, is it not clear that the habitual use of

[1]When 7 men die of tuberculosis for every 4 women dying from the same cause, there must be some lethal factor to which men are more exposed than are women. What agency can be named more likely to be the culpable factor than the masculine habit of smoking?

tobacco, along with alcohol, must be eliminated from human society if any considerable increase is to be made in maximum longevity?

The Committee to Study the Tobacco Problem has recently issued through the publishing house of Paul B. Hoeber a digest of scientific clinical and laboratory data on the relation of tobacco to health and efficiency, together with an annotated bibliography prepared by Professor Pierre Schrumpf-Pierron, Professor of Clinical Medicine in the University of Cairo. This work lists about one thousand scientific papers, nearly every one of which presents clinical or laboratory data showing the toxic effects of tobacco upon the human organism. No intelligent person can peruse this great mass of scientific data without being thoroughly convinced that tobacco is a devitalizing agent of great potency and that its use is an undoubted factor in shortening human life.

COFFEE DRINKING HOSTILE TO LONGEVITY

Another poison habit that is hostile to longevity is coffee drinking. Caffein is an alkaloid that manifests its toxic effects upon the heart and blood vessels. Caffein is a pressure-raising drug. *The Journal* of the Iowa State Medical Society utters the warning that "old people should avoid tea and coffee not only because they are undesirable irritants of the nervous system, but also because they have a harmful effect on the blood pressure." As the blood pressure naturally rises with the advance of the old age process, it is evident that a pressure-raising drug must hasten senile changes and thus shorten the life of the user.

The well-known effect of tea and coffee in producing insomnia must tend to shorten life by interfering with the natural processes of repair which take place during sleep. Sleep, as the old adage runs, is Nature's sweet restorer. But this is true only of sound, normal sleep, not of the troubled fitful sleep of the coffee user.

The extensive use of cereal coffees and decaffeinated coffee in recent times has tended somewhat to lessen the injury from this source, but the gain thus made has probably been more than counterbalanced by the increased consumption of caffein in the form of cola drinks. A glass of Coca Cola contains about as much caffein as a cup of coffee. The same is true of other cola beverages.

Coffee is particularly harmful for persons past middle age. It becomes more and more dangerous with advancing years for the reason that it increases the tendency to over-exertion by paralyzing the fatigue center. Elderly persons are naturally disposed to exert themselves to an imprudent degree for the reason that they feel the effects of fatigue the next day instead of at the time of exertion, so-called secondary fatigue. Coffee unquestionably increases the wear and tear of the body,

and hastens the arrival of the time when the human machine will be ready for the scrap heap.

A person who does not feel comfortable and fit for duty until after his usual cup of coffee is a coffee addict, and is as truly a slave to caffein as is the opium smoker to his narcotic.

OTHER DRUG HABITS SHORTEN LIFE

There are numerous other enslaving drugs. One of the newest of these is aspirin. A drug habit of any sort shortens life. All drugs are baneful, some causing mental and moral as well as physical injury. Every one of these habit-forming drugs must be made taboo if we desire to promote individual and racial longevity.

HEREDITY A FACTOR IN LONGEVITY

Heredity is undoubtedly a factor in determining the length of life. Inquiry into the family history of centenarians rarely fails to reveal the fact that great length of days is characteristic of the individual's family. The late Dr. Alexander Bell showed the unmistakable influence of heredity in determining the life span.

This hereditary endowment, commonly called "vitality," or "stamina," although not easily defined, is nevertheless a real thing, and it is not impossible that science may sometime provide means of measuring it. Indeed, some progress has already been made in that direction.

WE MAY LEARN TO MEASURE "VITALITY"

Many years ago (1889), the writer had the pleasure of spending a little time in the laboratory of the eminent English physiologist, the late Doctor Waller, who at that time was studying electrical phenomena in plants and animals with the aid of a recently discovered, highly sensitive means of measuring electrical currents. In one of the experiments, I plucked a leaf from a shrub growing in the adjacent garden. Electrical measurement showed the electromotor force to be lower on the injured surface of the stem, where it was separated from the plant, than on the intact surface of the leaf. Applying the same test to seeds, Doctor Waller found that the electromotor force diminished with age. For example, the electromotor force of a seed five years old was less than one-tenth that of a seed one year old.

There seems to be ground for the hope that some time, by electrical or other means, we shall be able to measure the vitality, or stamina, of a man. At the present time the surgeon recognizes the fact that in spite of every precaution he may take, the patient upon whom he is about to operate may be of the *morituri* type, and may suddenly pass out during so simple an operation as the removal of a diseased tonsil or an inflamed appendix. When we are able to measure

vitality in terms of electrical volts, we may be able to estimate with a considerable degree of accuracy the length of time a person may live, but even then the length of his life span will depend as much upon the rate at which his vital machine is run, and the care given to it, as upon its original endowment of durability.

BENJAMIN FRANKLIN'S RIGHT-ABOUT FACE

That there is a distinct relation between habits and length of life is a fact so generally recognized that it need not be argued.

Benjamin Franklin lived the simple life in his youth and profited so greatly by so doing that he became remarkably athletic. He was the greatest swimmer of his time, and had extraordinary strength and endurance. He unfortunately fell from grace when he became popular and famous and in his old age suffered greatly from gout in consequence. At the age of seventy, he wrote to a friend:

"Being arrived at seventy, and considering that by traveling further in the same road I should probably be led to the grave, I stopped short, turned about, and walked back again; which done these four years, you may now call me sixty-six."

"Walking back" is a most agreeable experience, and a most profitable kind of exercise.

The average man of sixty or seventy years is prematurely old, made so by having burdened his body unduly and overtaxed his vital machinery. By change of habits, renouncing all self-indulgence, and living the simple life, the injury done will not be repaired, but the damaged and crippled machine with a lightened load will function better and will last longer, thereby securing a sort of rejuvenation. If Franklin had reformed his habits at sixty instead of seventy, he might have "walked back" ten years instead of four. The amount of rejuvenation that is possible depends upon the extent to which one's safety margin has been consumed. When the original endowment of vital stamina with which one is born is completely exhausted, "walking back" is no longer possible. The earlier in life one begins to economize and conserve his safety margin, the less occasion there will be for "walking back," but the fact that so much may be done in the way of renewal of youth by biologic living is adequate proof of its importance as a means of increasing human efficiency, happiness and longevity.

For more than fifty years, the writer has devoted a large share of his time to the study of means by which men and women crippled by disease and prematurely old may "walk back," and has had the satis-

faction of seeing many thousands of persons undergo various degrees of rejuvenation by a radical change of habits.

REASON VERSUS FASHION

That wise old Roman philosopher, Seneca, who, according to the Elder Pliny, was the most learned man of his age, keenly appreciated the importance of habits in relation to health and longevity. In writing to a friend, Lucillius, he gave him the following wise advice that is even more applicable to the highly sophisticated customs and manners of the present time than to those of the times when the advice was given:

> "There is nothing against which we ought to be more on our guard than, like a flock of sheep, following the crowd of those who have preceded us, going, as we do, not where we ought to go, but where men have walked before. And yet, there is nothing which involves us in greater evils than following and settling our faith upon authority—considering those dogmas or practices best which have been received heretofore with the greatest applause, and which have a multitude of great names. We live not according to reason, but according to mere fashion and tradition.
>
> "We shall recover our sound health if only we shall separate ourselves from the herd, for the crowd of mankind stands opposed to right reason—the defender of its own evils and miseries. . . . Human history is not so well conducted that the better way is pleasing to the mass. The very fact of the approbation of the multitude is a proof of the badness of the opinion or practice. Let us ask what is *best,* not what is most *customary;* what may place us firmly in the possession of an everlasting felicity."

IT IS WITHIN THE POWER OF MAN TO CREATE A NEW HUMAN RACE

But this paper is already too long and must be brought to an end, although I have only mentioned a few of the life-shortening practices that are not only handicapping progress but initiating new and destructive degenerative disorders, as shown especially in the increasing morbidity and mortality from circulatory diseases. The purpose of this paper has been to make clear that public health measures will never do more than increase the *average* longevity, and that the limit of this average will not exceed 80 or possibly 70 years.

That there will some time be a new human race, a race far superior to the present, is believed by many scientists. It is within the power of man so to modify his environment and so to control the evolutionary forces that are working upon him as to eliminate degenerative and destructive tendencies and to promote, encourage and intensify the forces

making for Race Betterment. Thus he may improve desirable qualities and eliminate defects and undesirable characteristics, and in time produce a race of human thoroughbreds that will be as much superior to the average existing man as is the thoroughbred horse to the average horse of the farm.

Bichat's declaration that civilization "is nothing more than the environment which tends to destroy humankind" was perhaps too sweeping, but it is now generally admitted that the conditions of civilization are in general such as tend to race destruction rather than Race Betterment. The greatest problem before the world today is how to save the human race. The one hope is in biologic living; that is, a straightforward and thoroughgoing regulation of our life habits in harmony with the known facts of human physiology.

The time has certainly come when the human race should take itself in hand and mark out for itself a regimen which will lead toward race improvement to replace our present reckless, self-indulgent mode of life which is driving us down to race extinction.

A new program of right living is needed; a program based on physiology and biology. A scientific conscience must be developed. Respect for the human body and for the noble human race must be cultivated. Eugenics, race hygiene as suggested by Galton, and euthenics, individual hygiene, must be made a religion, or rather a supplement to all other religions.

THE MECHANISMS OF NORMAL DIGESTION AND THEIR SIGNIFICANCE

Dr. Andrew Conway Ivy, Head of the Division of Physiology and Pharmacology, Northwestern University Medical School

Everyone is cognizant of the wonderful advances in the sciences of chemistry and physics. These advances have permeated our social and industrial life to such an extent that at present they are indispensable. Every industry of any importance is based upon the use of a series of wonderful chemical and physical processes, so wonderful that the unspecialized mind is mystified, and exclaims, "What will be done next!" Yet, when we stop to consider the numerous and complex processes that occur in the digestive canal of the living organism, industrial processes become simple.

A large majority of the chemical elements in many combinations enter the digestive canal, and are subjected to known and unknown chemical and physical processes. Various complex reagents, or digestive juices, are secreted that have a specific action on the food materials, rendering them capable of being absorbed and of maintaining the processes of life. It is with the causes and mechanisms of formation of these complex reagents, or digestive secretions, that I and my collaborators have been and are chiefly concerned.

GASTRIC SECRETION

Recent experiments have shown that the secretion of gastric juice can be divided into three phases, depending on the site at which the stimuli are acting: (1) The cephalic phase, (2) the gastric phase, and (3) the intestinal phase.

The cephalic phase of gastric secretion is caused by the sight, taste, and smell of food. The impulses pass via the cerebrum, thalamus, midbrain, medulla, and vagus nerves to the stomach. Even the suggestion of appetizing food to the hypnotized subject will cause the gastric glands to secrete.

The gastric phase of gastric secretion is due to the mechanical distention of the stomach by food and to the action of chemical substances either in the raw food or produced by the digestion of the food.

The intestinal phase of gastric secretion is caused by the action of chemical substances produced during digestion. The digested food products, and possibly amines produced by bacterial action, excite the gastric glands by acting via the intestine.

We were able to study the gastric and intestinal phases by crucial experiments, because it was possible for us to make a pouch of the entire stomach with the vagus nerves cut. This was done by sectioning the stomach from the esophagus and duodenum, closing one end and bringing the other end of the stomach to the outside, and then suturing the duodenum to the esophagus. In such a preparation it is possible separately to study the effect of substances entering the intestines and the effect of substances applied directly and only to the stomach.

It is interesting to note that such animals change their habits of eating immediately, i. e., they no longer bolt their food. Raw meat is very irritating to their intestines and is not digested. Cooked meat is not irritating. Some of these animals have developed, several months after the operation, an anemia that we have been able to cure and to prevent by the administration of cod liver oil and iron (ferric citrate). This animal preparation makes it possible to study the effect of prolonged absence of gastric secretion on the organism. We have observed that hot weather is very hard on the animals; some have developed and have died of an enteritis during hot weather. We believe that this is due to the absence of the bacterial sterilizing action of gastric juice, the bacteria growing more rapidly in the water and food in the food pans during hot weather than during moderate weather.

By transplanting a small pouch of the stomach under the skin, and by observing that it secreted gastric juice when the animal was fed, we were able to prove that, when we eat, something passes into the blood that stimulates the gastric glands.

Normal sleep promotes the flow of gastric juice, because mental activity inhibits the gastric glands. Worry, "nerve-strain," unpleasant sensations, markedly inhibit the secretion of the stomach, and cause disturbances of the motility of the entire gastro-intestinal tract.

PANCREATIC SECRETION

The pancreas produces the most important digestive secretion, because of the completeness and diversity of its action. Our present knowledge shows that its secretory response to a meal can be divided into two phases: (1) The cephalic phase, and (2) the intestinal phase.

The cephalic phase is due to the sight, smell and taste of food. The secretion that results is meager in quantity, however, when compared with that which occurs in the stomach.

The intestinal phase is more important because most of the pancreatic juice is secreted during this phase, which is caused by the action of gastric juice, bile and digested food acting in the intestine.

By transplanting the tail of the pancreas and a loop of the intestine under the skin in the same animal, and by observing a secretion of the

pancreatic transplant when substances were applied to the intestinal transplant, we have proved that a hormone is concerned in the secretion of pancreatic juice.

Fortunately for our health, the pancreas is apparently less subject to inhibitory nerve action than the gastric glands. Physical and mental distress does, however, cause a decrease in the response of the pancreas to stimulating agents. If the pancreas does not secrete its digestive juice, grave digestive disturbances result, more grave than those that result from a failure of the gastric glands to secrete.

GALL-BLADDER

It is well known that bile plays an important rôle in normal digestion; but its elimination from the biliary passages has not been thoroughly understood, primarily because the function and physiology of the gall-bladder have not been completely settled by crucial experiments.

Some have maintained that the gall-bladder never empties, i. e., the bile that goes into it is absorbed into the blood and re-excreted by the liver. Some believe that during the interdigestive period bile does not flow into the intestine, but that it passes into the gall-bladder where it is stored and concentrated. That the gall-bladder concentrates bile is thoroughly established. The storage and concentration of bile by the gall-bladder, it is believed, serves to regulate the pressure in the biliary passages, and to hold in readiness a supply of bile to start intestinal digestion at the next meal. Some believe that when a meal is ingested the gall-bladder empties itself by actively contracting, while others believe that it is emptied passively by suction produced by movements of the duodenum, or by the flow of liver bile past the orifice of the gall-bladder duct. It is highly probable that if we knew more about the physiology of the gall-bladder, we would be able to prevent the occurrence of gall-stones.

It is now well established that fats, egg-yolk, cream, acids, and meat protein cause the gall-bladder to empty at least partially. How these substances cause the gall-bladder to empty is not known.

Because these substances are potent excitants of the pancreas, and since it is possible to extract a substance from the intestinal mucosa that stimulates the pancreas to secrete, it occurred to us that a substance might be extracted from the intestinal mucosa that would cause the gall-bladder to empty.

We have found that a purified extract of the intestinal mucosa will cause the gall-bladder to contract and empty. If a small quantity of 0.4 per cent HCl acid, or 2 per cent butyric acid is placed in the duodenum, the gall-bladder is caused to contract. If two compatible

dogs are prepared for a carotid-to-carotid cross-circulation experiment, with their gall-bladder duct clamped and the gall-bladder cannulated and connected to a pressure recording apparatus, and then thirty or forty cc. of 0.4 per cent HCl acid is introduced into the duodenum of one of the pair, the gall-bladders of both animals contract. The gall-bladder of the one receiving the acid contracts within two minutes and the other contracts about eight minutes later.

These observations strongly suggest, if they do not prove, that the gall-bladder is caused to contract and empty at least in part by a hormone, which is secreted into the blood stream when certain substances such as acids, fats, egg-yolk, etc., come into contact with the upper intestinal mucosa.

SUCCUS ENTERICUS

The secretion of juice by the cells of the intestinal mucosa is an important digestive reagent, but is less potent than that of the pancreas. Its secretion is excited chiefly, if not entirely, by local mechanical and chemical agents in the intestinal contents.

THE IMPORTANT PROBLEM

The most immediate and important problem that confronts us at the present time is the isolation in pure form of the hormones, or chemical excitants, of the mechanisms concerned in the elaboration and elimination of the digestive juices. The practical uses of "gastrin," the gastric secretory excitant, of "secretin," the pancreatic secretory excitant, and of "cholecystokinin," the gall-bladder excitant, are too numerous to mention in the time I have at my disposal.

The relation of normal digestion to the prolongation of life, increased efficiency, well-being and race improvement is quite obvious. In closing I desire to recommend and to urge that the non-manual-laboring public be taught to think of their food and pleasant things while eating, to eat lightly of easily digested food prior to and during a day fraught with "business worry," "mental or nervous strain," and to eat bountifully only when the meal can be followed by several hours of leisure and relaxation, free from the nervous inhibitory impulses that deleteriously affect the formation of the digestive juices and gastro-intestinal motility.

THE APPLICATION OF PHYSIOLOGY TO LIVING HABITS

WILLIAM ALFRED SAWYER, M.D., Medical Director, Eastman Kodak Company.

Any discourse on this subject, except for individual cases, must be considered largely speculative. I have been unable to learn of any well-organized, significant effort being made at this time to apply the now available knowledge of human physiology to the actual daily living of any representative cross section of our adult population. Second, from my own experience and from the attitude of many others, I am led to assert my belief that there is a very definite need for such application, and also to suggest a possible scientific procedure through which a positive contribution to human welfare may be developed. In order to state the situation clearly, a short résumé of steps already taken in industry towards decreasing physical disability will perhaps be necessary.

ACCIDENTS WERE FOUND PREVENTABLE

The first Workmen's Compensation Laws were passed in the year 1911. Washington, Kansas, Nevada, California, Wisconsin, Illinois and Ohio in the West, and New Jersey, New Hampshire and Massachusetts in the East, were among the first to take the step, but since then practically all have adopted such laws. From that time, industry has had, therefore, a definite responsibility for injuries sustained by those employed. Because of the great unnecessary waste, steps were soon taken towards prevention.

In 1912 a cooperative, non-commercial association was formed for the prevention of accidents. This association, known as the National Safety Council, is supported by practically all of our industries. And so came "Safety First." This organization soon demonstrated that their field held almost limitless possibilities for benefit, both to employer and employee and that tremendous savings could be effected. Industry soon found that, from the economic standpoint, even so-called minor injuries were at least potential losses, and that a physician was needed to care properly and promptly for these as well as for the obviously severe injuries. The physician was used chiefly, however, where the number and severity of accidents actually necessitated his employ.

BACTERIAL ILLNESSES ARE PREVENTABLE

One of the serious problems of modern industry is, however, the time lost from illness. This is, in the aggregate, about eight times that lost from accidents, and the actual cost in dollars and cents far exceeds that due to injury.

The physician in industry is, therefore, continually confronted with the importance of physical fitness and its maintenance. He does much thinking along lines of health habits, therefore—perhaps more than in any other branch of medical practice.

Health is not a negative state, an absence from disease; it is a positive asset, a vivid thing of happiness and efficiency, but seldom found after middle life except as the result of physiology applied. The prevention of communicable disease is primarily the function of the federal, state and city health departments. Fortunately a very definite reduction is already shown, and indeed to such an extent that if bacterial diseases were the greatest cause of illness we could anticipate ere long a really healthy population.

NOW WE NEED A GOOD HEALTH CONSCIOUSNESS

There is another group of diseases, however, that are insidiously and rapidly on the increase, those known as degenerative diseases. These are largely brought on by a lack of the application of available knowledge to living habits. I do not know whether or not our present day pace is compatible with man's best development. It is disputed, with much evidence available to the negative. But the facts are that all of us feel its intensity, and that men break before their time and spend more days in the repair shop and on the shelf than they should. In an article by Dr. Chapin in the current *Forum,* entitled, "Is Life Worth Prolonging?" he states: "It is now recognized by physicians and health officers that fully one-third of the number of deaths are induced by preventable causes that can at *least* be warded off for a time." It is safe to say that these preventable causes perhaps extend further into the field of illness than we realize.

The National Safety Council with industry has developed an educational procedure, through its machine inspections, development of safeguards, and "safety first" education, that has had a definite effect in creating a "safety first" consciousness. What has been done and is being done toward accident elimination can, in its own way, be done in illness prevention, and a real "Health Consciousness" established. In that fact lies a tremendous challenge that, if accepted, would create a very great asset for industry, and contribute inestimably to public health and to Race Betterment.

INDUSTRY OFFERS SPECIAL OPPORTUNITIES FOR THE APPLICATION OF HEALTH KNOWLEDGE

Those of us in the medical profession who are connected with industrial organizations have come to realize that a significant need exists among workers. Likewise, we have come to recognize the opportunity to meet this need through industrial contacts. In one in-

dustry of 10,000 employes, there are 100,000 contacts between the medical department and the employes each year. This is an average of ten contacts per employee. The advantage of these contacts is the individual and personal quality of them, with the ever present opportunity of checking back and following up, a privilege that neither a municipal health department nor a private physician enjoys to the same extent. Furthermore, there is the advantage of the influence of the industry with the individual, who, lacking certain initiative or interest, will do willingly what his employer advises, even when he ignores all other admonitions. Many people need some one to make up their minds for them.

"Industry, which gathers adults together, provides the means for bringing preventive medicine into direct personal contact with the adult," says Dr. Edgar Leigh Collis, of the University of Wales. "If the industrial part of the adult population were sound in health, there would be no need for much else." It seems to me that merely to urge people to correct impairments, to pursue better habits and thereby to enjoy better health, is altogether too slow a process. Education along these lines can be greatly hastened if some pressure can be brought to bear by the business management. Economic pressure is a powerful persuader, and it is legitimate to use when definitely for the best good of all.

HEALTH FROM THE BUSINESS POINT OF VIEW

The asset of good health has not been properly evaluated. In a study made by me of the relation of industrial medicine to community health, I found that all through the workaday world there are preventable or correctable human liabilities, doing, half-heartedly and ineffectively, jobs that should be done thoroughly and efficiently. These individuals should be made to know that they can be put into condition to do a higher quality of work, and that without a spirit of cooperation there is no chance ahead of them. The worker must be held somewhat responsible for his ill health. I stress this because I have seen it tried out in part, and I know that often it is the only thing that works. It benefits most the individual who is forcefully persuaded to heed the advice given, and in the end he is glad. Commerce has such a grip on all our thinking and standards of judgment that health from the business point of view is bound to present itself in an increasingly convincing way.

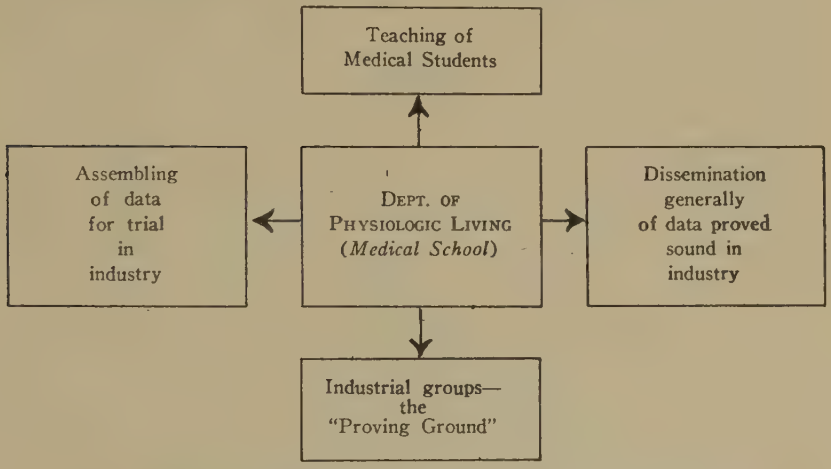
A NEEDED DEPARTMENT OF PHYSIOLOGIC LIVING IN OUR MEDICAL SCHOOLS

At the present time there is no properly organized propaganda to influence the business world in regard to preventing illness. Industry of itself cannot, I believe, undertake to do such a task as it should be done. If, however, a Department of Physiologic Living, for instance,

were established in one of our medical schools, and aligned with a suitable industrial establishment for the purpose of putting into practice reliable and authentic facts pertaining to personal hygiene, instead of the present all too prevalent opinions, conclusions could then be drawn, facts assembled and their value proved, and an opportunity could be given to work from a sound basis.

We should then have a source of authentic information on health habits upon which to rely. We certainly need standards, properly interpreted, in order to avoid misunderstanding in the measuring of the vast amount of reliable and unreliable information appearing in our periodicals and daily press.

Diagrammatically the arrangement would appear thus:



I do not advocate turning the industry into an experiment station. If properly handled such tests could be carried on without hampering production and would, I believe, react to fortify the company involved in its high pressure production.

Lastly and finally, Race Betterment along any line is always an individual affair. Education, to be effective, must be "caught." If a recognized authority advocates certain habits for other people, but himself acts to the contrary, the great mass of the people are deprived of any real leadership. Medical students and physicians are notorious for their own disregard of health habits. I am convinced that a large responsibility for this lies in the fact that the medical school is usually unconcerned with its obvious duty of inculcating the need of health habits on the part of their own students. The subjects of disease and treatment are, however, passing their zenith. A new day is unquestionably dawning, with the maintenance of health as its big business.

SOME FACTORS INFLUENCING THE TOXIC EFFECT OF ALCOHOL

WALTER R. MILES, Professor of Experimental Psychology, Stanford University.

The morning edition, August 15, 1914, of the *Berliner Tageblatt,* under the heading, "No Alcohol," quoted the following notice signed by von Bessing, Commanding General of the German Army: "It has come to our notice that alcohol has been frequently served to our troops at railway stations and social centers although this has strictly been forbidden. I bid our citizens to respect the regulation unconditionally. It is clearly obvious that efficiency and powers of resistance must be appreciably lowered through the use of alcohol. At this serious moment we need the full powers of each and every soldier. Whoever contributes to the reduction of these powers injures the common interest and sins against our Fatherland, to which—today more than ever—all our energies belong."

The fourth of ten hygiene commandments issued to the Saxon soldiers by their staff physician is as follows (*Allegemeine Land-Zeitung fur Sachsen,* Evening Edition, August 15, 1914): "4. Drink no beverages containing alcohol; wine, beer and schnaps even in small quantities cause weariness and weaken efficiency."

These two quotations will serve to introduce my brief discussion on alcohol this evening. They are backed as war measures by the scientific work of the last twenty-five years. Probably it would be hard to find at present a reputable physician, physiologist, pharmacologist or psychologist who would not agree that the quoted statements were justified, at least under the circumstances of war. I imagine that most of the members of this Congress feel them applicable to conditions of peace as well as of war. It is in general no longer necessary to argue that alcohol characteristically produces a decrease in the efficiency of voluntary functions. If you were to propose studying the effect of alcohol on marksmanship and would carefully control the conditions so that the learning from increasing practice would not be allowed to confuse the results, practically any scientific group would confidently expect the alcohol results to show poorer target scores than normal.

EFFECT OF ALCOHOL ON TYPEWRITING

Similarly if you will study the effect of alcohol on such a practical commercial activity as running a typewriter, the decreased efficiency will be quite evident. One ounce of alcohol diluted to eight ounces of fluid taken without food will cause the average skilled typist (moderate drinker class) to make about one-third more errors than usual. Many

of these errors will be found so grave as seriously to reduce the legibility of the copy. The effect from one such drink of alcoholic beverage reaches its maximum 30-90 minutes after it has been taken. The speed of typing is only slightly (2—3 per cent) reduced. Hence it is quite possible for the typist who is gauging his own work in number of pages turned out to think that alcohol does not interfere and that there is little basis for "hygiene commandment number four" quoted above. One of the things we know best about the characteristic alcohol effect on human beings is that the person who has taken it is not at that time a good judge or critic of his own performance. This is not a place to apply the commercial dictum, "Ask the man who uses it," for he is just the person who does not know. Herein alcohol presents a treacherous mental trap like certain other substances that can modify human behavior and personality.

EFFECT ON EYE MOVEMENTS

To take another illustration, if you photograph the eyes as they execute the complicated, rapid movements occasioned by the reading of a page of printed matter, you will find that after the ounce of alcohol the eyes move more slowly. Even though the situation is less complex and the subject has only to look back and forth from one signal point to another in the simplest possible arrangement, the decreased speed of the eye movements after alcohol will still be found. Suppose you explain the matter to the man whom you are studying, tell him that the alcohol has slowed up his speed in looking from place to place, as he would do in taking in the situation at a railroad crossing, and ask him voluntarily to try very hard to bring back his normal quickness. He tries to combat the depressant action, but he does not succeed; he cannot voluntarily compensate for it.

Results of this kind could be multiplied. They are now almost commonplace. They have appeared from many laboratories, notably from the Nutrition Laboratory of the Carnegie Institution of Washington.[1] Even the newspaper is ceasing to call alcohol a stimulant.

A PHYSICAL AND MENTAL DEPRESSANT

It is a human trait to give any substance or action a classification name and to make this term all inclusive. If we analyze the situation it will, I think, seem quite natural that alcohol should at first be called a "stimulant." This would result from (1) experience in giving it to sick or pathological individuals and (2) observations on normal sub-

1. Published results from experiments with alcohol on human subjects may be found in: Dodge and Benedict: Psychological Effects of Alcohol—An experimental investigation of the effects of moderate doses of ethyl alcohol on a related group of neuro-muscular processes of man. Carnegie Inst. Wash. Pub. No. 232, 1915; Miles: Effect of Alcohol on Psycho-physiological Functions. Carnegie Inst. Wash. Pub. No. 266, 1918; and Miles: Alcohol and Human Efficiency—Experiments with moderate quantities and dilute solutions of ethyl alcohol on human subjects. Carnegie Inst. Wash. Pub. No. 333, 1924.

jects. With the ailing individual we are dealing with bodily or mental functions that are out of order but perhaps more frequently depressed. This depression is by reason of weakness and also due to what the physician or physiologist would call "inhibition from reflex action," often arising from the higher centers. Fear and anxiety may operate in this manner. It is therefore clear that a narcotic action on the higher centers would tend in many cases to reduce this factor of inhibition and thus bring about some heightening of the previously depressed functions.[2] Such a change observed in a sick or exhausted person could easily cause the ordinary individual or even the clinician to reach the conclusion that alcohol was a stimulant. It is this class of evidence that has been at the basis of the prolonged Binz-Schmiedberg controversy, on the nature of the alcohol effect. Binz maintained that alcohol was a stimulant while Schmiedberg, whose point of view appears vindicated by the later scientific analysis, maintained that alcohol was a narcotic.

Data for the effect of alcohol on normal subjects, which might easily lend itself to the assumption that alcohol is a stimulant, concerns chiefly the effect on the pulse rate, the skin temperature, and metabolic processes. Body temperature in normal health is a very constant factor. There is good agreement on the fact that alcohol acts as a superficial vaso-dilator, causing more blood to appear in the skin capillaries. The skin temperature is somewhat higher as a result of this change in circulation, and since the sensitive endings for the experiences of cold and warmth are chiefly in the skin, the individual may easily conclude that he has experienced a stimulating action because his hands "feel" warmer. The same line of argument applies to the pulse rate. In normal subjects it tends very definitely and consistently to be somewhat faster after alcohol ingestion; taking just that much of the result, it is easy to jump to the term "stimulant." But the increased rate appears on analysis to come from a partial depression of the vagus center, which acts as a governor on the heart rate, adjusting it quickly and accurately to the physical demands made on the body. After taking alcohol, the heart rate associated with a given piece of work carried out in a given way and at a given rate will almost without exception be found faster than when the normal individual has not taken the alcohol.

These illustrations I think faithfully represent the conditions that early caused alcohol to be popularly and medically placed under the classification of "stimulant." Von Bessing, quoted above, was careful not to call it a stimulant. Anyone who carefully scrutinizes the scientific data at present available will find that the term "depressant"

2. See Dale and others. Discussion on the value of alcohol as a therapeutic agent. Proc. Royal Soc. Med., Section on Therap. and Pharm., 1920, Vol. 13, Part 3, 31-58.

is much more correct for fundamentally representing the general effect of alcohol on the normal individual's physiological processes and on the voluntary physical and mental efficiency.

For this field of discussion it may be assumed as axiomatic that *no one takes alcohol to escape an alcohol effect,* and further, no one has discovered a method for taking alcohol and at the same time keeping it away from the nerve centers. In other words, alcohol is usually taken because the typical alcohol effect, in some degree, is wanted, and this effect, the nature of which can be predicted, results from the influence that this substance has on the nerve centers. It is usually taken by mouth, that is, as a potable beverage. It can be mixed with food or sniffed up through the nose, inhaled as alcohol vapor, given by rectal injection, absorbed through any of the mucous membranes, or it can be introduced by a hypodermic needle directly into the circulation or intramuscularly. No matter how it is taken or given, it is generally admitted that alcohol is unchanged by the processes of introduction, ingestion or absorption. The point is that alcohol is so highly diffusable that it readily gains access to the circulation and hence comes in contact with the nerve centers.

There are certain factors that definitely influence the alcohol. These are (1) dilution, (2) the rate of and conditions of toxic effect that may be expected from a specific amount of ethyl ingestion, (3) the intensity of physical activity or exertion after ingestion, (4) the law of nerve action in reference to rate of environmental change, and (5) the factor of native or acquired tolerance. These factors are fundamentally involved in connection with legislation about alcohol and in all medical and psychological practice where it is necessary to identify intoxication from alcohol and to estimate its degree.

DILUTION INFLUENCES ALCOHOL EFFECT

In the time at my disposal I cannot do more than touch briefly on some of these important points. First, on the matter of dilution. The two charts reproduced in Figure 1 represent data carefully collected on nine young men mostly of the moderate or occasional drinker class, each of whom was given a certain dose of alcohol in a certain dilution. As is made clear by the composite diagrams, on one day (See Chart A) the men were each given 27.5 grams of alcohol in 1000 cc. of beverage, and on another day (See Chart B) the same men were given the same amount of alcohol in 100 cc. of fluid. Therefore in one case the beverage contained 2.75 per cent of alcohol by weight, in the other case 27.5 per cent of alcohol. An attempt was made to have the conditions for both experiments identical. It will be noticed that although the same amount of absolute alcohol was taken, the curves representing

the amount of alcohol appearing in the blood and urine show smaller values when the greater dilution was used. The maximal value in the blood in A is .30 and in B, .45. Similar ratios may be noticed for other compared points for the two charts. Therefore we may conclude that identically the same weight of absolute alcohol taken in a concentrated solution produces a definitely higher alcohol content in the blood and urine than when taken in a much more diluted solution. The alcohol

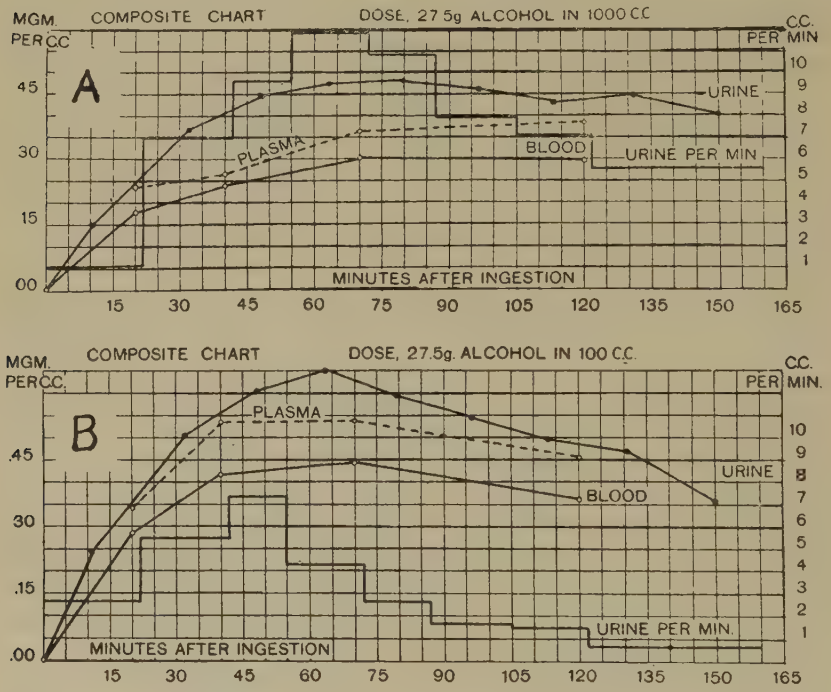


FIGURE 1. Comparative results for alcohol found in the body fluids after taking the same absolute amount of alcohol in two dilutions. Composite results for nine men.

content in the urine is about 50 per cent higher than that appearing in the venous blood. This result was first shown by Miles,[3] in contradiction to a good deal of previous theorizing on the diffusion of alcohol. The result has since been confirmed by Southgate and Carter[4] and also by Simonin,[5] and it is now realized that urine samples may be used for analysis in connection with medico-legal identification of intoxication.

It is perfectly obvious that this same factor of dilution operates also in connection with food. If the alcohol is consumed at the same time

3. Miles. The comparative concentrations of alcohol in human blood and urine at intervals after ingestion. Jour. Pharm. and Exper. Therap., 1922, XX, 265-319.
4. Southgate and Carter. Excretion of alcohol in the urine as a guide to alcoholic intoxication. Brit. Med. Jour., 1926, March 13th, pp. 463-469.
5. Simonin. Recherches medico-legales sur l'intoxication alcoholique aigue. Strasbourg Medical, 1926, LXXXIV, pp. 175-203.

that food is being eaten, or when food is in the stomach, it is thereby diluted and its rate of absorption and appearance in the blood, that is, its coming into contact with the nerve centers, is retarded. The importance of the food factor was clearly shown by Mellanby[6] in 1919, through an extensive and prolonged series of experiments on dogs; it has always been more or less considered—"more" in the customs of everyday life, "less," strangely enough, in the experiments made on animals and humans. In a long letter[7] dated December 24, 1897, by Professor Hugo Kronecker of Germany to Professor Henry P. Bowditch of Harvard, written at the time of the investigations made by the "Committee of Fifty," Dr. Kronecker wrote in part: "We have the essential proof that the concentration, not the absolute amount of ether, decides the effect. . . . It would be interesting to study if the effects of dilution decide the given dose of alcohol and its effect upon the vegetative and animal system of the dog. Hodge said in his paper that 6 cc. of alcohol in a 40 per cent solution was mixed with the dog's breakfast. This mixture with the breakfast is a further unknown dilution. I remember very well at the time of my student days in Leipzig that the beer, the morning drink, was very dangerous before the taking of food, but after the food, as was customary with the Greeks, it was not so intoxicating." These obvious things about dilution and mixture, known for such a long time have not always been taken into account in alcohol experiments, but in the future no reputable worker can neglect them. To state the absolute amount of alcohol is not to define the dose.

The *rate of ingestion* is a corollary of the factor of *dilution.* The importance of both rests on the fundamental fact demonstrated in 1924 that the measured intensity of toxic effect depends in general on the height of alcoholic concentration appearing in the blood. If a given amount of alcohol is taken in small portions over a period of about 2 or 3 hours, it is perfectly obvious that the curve of concentration plotted for its appearance in the blood would be much flattened and differ from that obtained if the alcohol were all consumed within 5 or 10 minutes, as in the experiments reported in the curves of Figure 1.

ACTIVITY REDUCES ALCOHOL EFFECT

The phenomena of "walking off" or "working off" an alcohol effect are thoroughly known. This factor of *intensity of activity* following the ingestion of alcohol relates to the organism's disposal of the substance. It is of course well recognized that alcohol does not remain inert in the organisms, awaiting excretion. Of a given dose only about 2 per

6. Mellanby. Alcohol: its absorption into and disappearance from the blood under different conditions. British Medical Research Committee, Special Report Series, No. 31, London, 1919.

7. Original found by the author at the Harvard Medical School Library.

cent is excreted in the urine and a less amount in the breath. The remaining amount (95 or so per cent) is consumed in the tissues, and if there is an increase in muscular work, the consumption of the substance will be proportionally speeded up and hence there will be less of it (less

FIGURE 2. Apparatus for Measuring the Swaying of the Body.

alcohol per unit of time) to appear in the blood and exert an influence on the nerve centers.

EFFECT OF 2.75 PER CENT BEVERAGE ON BODY SWAY

The other factors to which I wish to direct your attention can more easily be discussed by using a concrete measurement from my laboratory. We will call this measurement "station." Figure 2 shows a simple apparatus for measuring the movements of the body when an individual stands with his feet still in a prescribed position, his eyes closed, and he attempts to remain motionless. After such a test, two

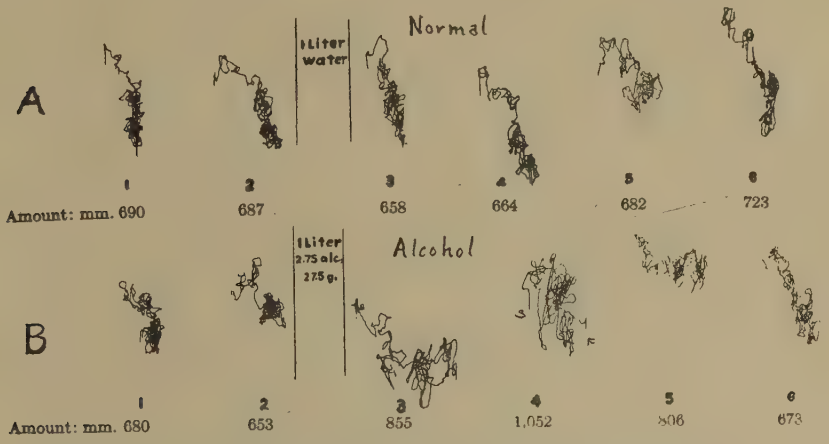


FIGURE 3. Illustrative results for the station test under normal conditions and after alcohol.

minutes in length, we can read from the 4 dials the amount of sway in each direction, and if we place a recording pencil on the subject's head, we can secure a graphic record showing the results as a tracing. The young lady who kindly posed for this picture, to make the nature of the test evident, was not a subject in the alcohol experiments (no women subjects were used). Sample series of station tracings together with total quantitative results for each trial are shown in Figure 3. From the days of Noah it has been recognized that alcohol has an influence on an individual's ability to stand. These results give us a quantitative expression for this age-old observation. The tracings were taken one-half hour apart. On the day represented by series A, it will be seen that the drinking of 1 liter of non-alcoholic beverage did not greatly modify the character or the amount of the swaying movements. The condition is quite different in the 1½ hours (records 3, 4 and 5 series B) after taking 1 liter of beverage containing 27.5 grams of absolute alcohol, i. e. a 2.75 per cent beverage. Here the area covered by the tracing is much enlarged, the sidewise component of sway

is relatively increased and the total amount of movement changes from about 700 to 1,000 mm. at the peak of toxic effect.

As you can imagine, the effects of alcohol on station can be demonstrated on almost any person, and quite small amounts or low dilution of alcohol will produce a change in this function. Suppose now we look at some charts that the Carnegie Institution of Washington has published earlier in a monograph of alcohol studies.[8] In Figure 4, Chart A, we have the combined results for eight men, each serving on four days, on two of which alcohol to the amount of 27.5 grams in a liter of beverage was taken, while on the other two the same volume of non-alcoholic beverage was consumed. Two sets of measurements were taken in either case before the beverage was ingested. The time of taking the beverage is indicated at the base in each of the three charts between 0-0. The plotted results with the non-alcoholic solution (control) make approximately a horizontal line, very little change. After the alcohol, however, swaying was increased and the curve dips down prominently, rising again to the level of the "control" at the time of 125 minutes after ingestion. The effect—computed difference between the alcohol and the control, taking into account the preliminary scores, found before the doses were ingested—is shown in the dotted curve. The prominent and important thing shown here is this: As the alcohol concentration rises in the blood and urine, the toxic effect becomes increasingly intensified and is strongest at the time when the content of alcohol in the blood has reached its maximum. After the maximum, and when the curves for the blood and urine begin to decline, the toxic effect shows rapid disappearance. Therefore, at the end of two hours, these subjects are able to stand with as little sway as normal, even though there is considerable unused alcohol in the blood and other body fluids, but the curve of alcohol content is on the decline.

WHAT IS A "NON-INTOXICATING" ALCOHOLIC BEVERAGE?

Observe in Chart B, of Figure 4, results on one subject who in this case had taken 2 liters of 2.75 per cent alcohol, that the maximum appearing in the urine (no curve for blood is given) is about two times that which shows for the urine curve in Chart A. Here again the alcohol effect intensifies rapidly as the concentration rises in the urine. When the peak of concentration has been passed and the curve starts to decline, the toxic effect recedes rapidly and first reaches the normal level 2¾ hours after the ingestion. At this time the content of alcohol indicated in the body is still 50 per cent higher than the maximal content that was reached in the experiments reported in Chart A, but it is a

8. Miles. Alcohol and Human Efficiency. Carnegie Inst. of Wash., Pub. No. 333, Washington, 1924, see p. 267 ff.

decline in place of an ascent. In Chart C, we observe this same law of alcohol effect in relation to the rise and fall of the alcoholic concen-

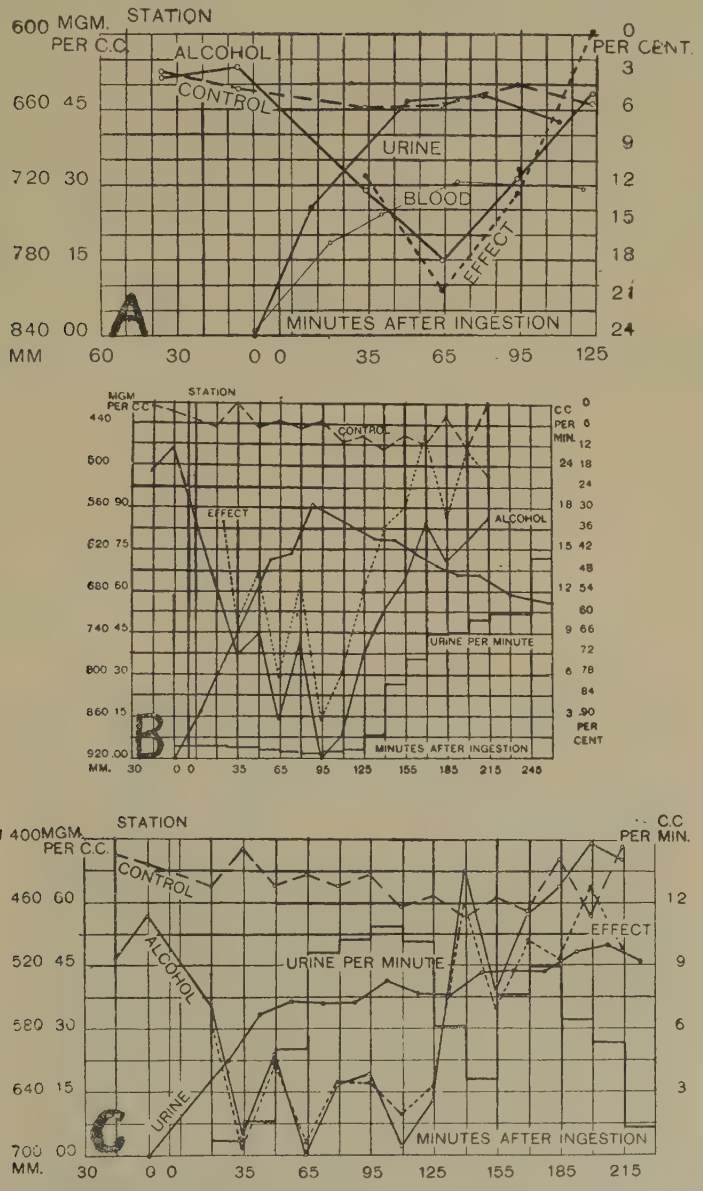


FIGURE 4. Charted results of alcohol experiments reproduced from Miles, "Alcohol and Human Efficiency." The relation of the toxic effect to the increasing concentration in the body fluids is exhibited.

tration in the blood operating in another circumstance. In this experiment made on one man, the liter of 2.75 per cent alcohol was ingested

at the point indicated, and then, beginning one hour later, a 50 cc. portion of this same standard beverage was taken at successive 15 minute intervals until 500 cc. additional to the original dose had been consumed. We notice that the curve for alcohol in the urine is thus made to rise continually during practically the whole experiment. However, the change after the maximum resulting from the 1 liter dose is quite slow and not large in total amount. Notice the effect of alcohol on the station measurement in this instance. The toxic effect is at first prominent when there is a rapid rise in the urine-alcohol curve, but after awhile, with the prolonged even though slightly increasing maximum, the effect practically fades away. From these results and others that might be demonstrated, if time permitted, we learn that the toxic effect of alcohol is not directly proportional to a given amount found in the blood. Much depends on whether this given amount or concentration value is on the rising or falling side of the curve. Herein we see exhibited the characteristics of nerve action. It has long been known, and indeed is demonstrated constantly in our daily lives, that *it is the rate of environmental change that produces prominent effects on us.* You know exactly when you mash your toe but not when you get the corn on your toe, even though both are from pressure. This law of stimulus gradient holds for vision, auditory experience, sensations of the skin, in reference to our judgment of same and different, and so on. It is a fundamental law in the functioning of the central nervous system. The working out of the relationship of this law to the question of defining "what is intoxication, and what is a non-intoxicating alcoholic beverage" has not yet been accomplished. It is indeed a complicated task and this is one of the main reasons why the whole alcohol problem, the world over, is in such a confused state.

THE MUDDLE AND MISHAPS OF THE ALCOHOLIZED RAT

With your permission, I will terminate this discussion by exhibiting some motion picture films showing sample results from very recent alcohol experiments made on animals. It is not quite practical to ask a rat to stand in our apparatus for measuring sway of the body. Usually such animals have been given alcohol, then placed back in their cages and observed. We can get a better idea of whether alcohol has essentially the same kind of an effect on a rat that it has on a man if we can have the rat do some complicated task. The device made to test him against the alcohol effect consists of an elevated set of paths, the nature of which can be understood directly from Figure 5. These small wooden frames are set together and so present a mazelike pattern. The rat runs along the top 30 inches from the floor. The path is everywhere 1 inch wide. There are 15 blind alleys. If the animal enters a blind he will have to turn around and leave it if he progresses to the

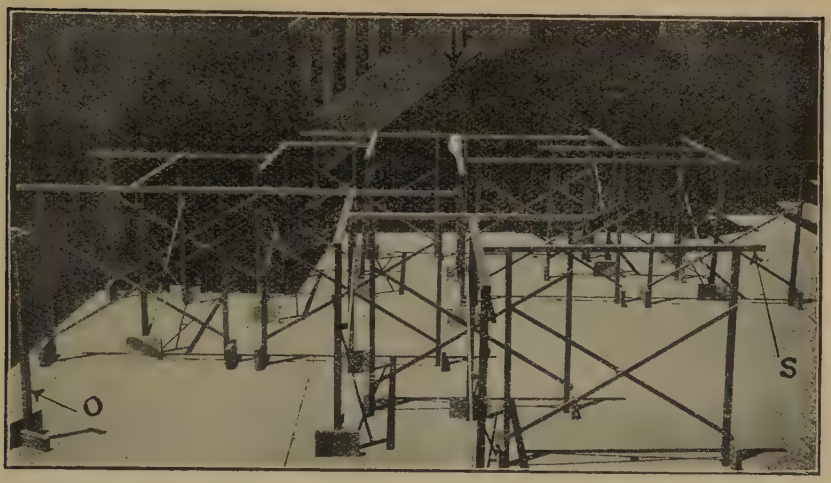


FIGURE 5. An elevated path one inch wide along which rats go to food. They start at S and find food at F. The odor is diffused by food at other places, O, about the maze. If a rat enters a blind it is counted as one error.

end where he finds food. The total length of the true path is about 32 feet. Now suppose we give an animal one trial every day in learning to go to his food on this path. He will learn to go without entering any of the blinds in 15 to 20 days, and then the trip from S to F will require only 15-25 seconds. He is now in readiness to be

FIGURE 6. Rat feeding on the maze. Under conditions of normal motor control a rat never falls off the one inch path, but after alcohol has been given he has great difficulty in keeping on it.

tested for the effect of alcohol or any other substance in which we might have interest. Although the path is narrow relative to the size of an adult rat (See Figure 6), it is found that animals with normal motor control, that is, not under the influence of some drug or excessively weakened through fasting, practically never fall off. If the hind leg happens to slip from the path, it is easy for such a normal animal quickly to recover position.

Ordinarily in alcohol experiments on animals, investigators have given doses equal to at least 4/1000 of the animal's body weight. In the trials that I now briefly report, the absolute alcohol was equal to only 1/1000 of the animal's weight. It was given as an intraperitoneal injection in a 10 per cent solution. In showing this film I have found it unnecessary to use a title or announce the topic. The behavior of the rat after alcohol is so typical of what we know as the characteristic alcoholic gait that it is recognized at once. Six minutes after the injection, the rat placed on the maze as a rule shows considerable motor incoordination especially when traversing the first half of the path. The gait is unsteady, the animal does not gallop along as he has done 15 minutes before the injection. The hind legs often slip from the path and sometimes the animal is unable to draw himself up on it again, but after hanging for a moment or two with his forelegs, drops down on the braces of the wooden frames. This prominent action on the hind legs is seen also in alcoholized dogs and of course is even more conspicuous in the effect of alcohol on man. Even though the path has been thoroughly learned by the rat, or we might in this case say "over learned," most of the animals make errors, that is enter blinds, after alcohol, although they do not seem to exhibit a great deal of retracing (going in the wrong direction on the true path). Marked improvement in motor control is found 15-20 minutes after injection. If the same dose is repeated an hour after the first injection, it will cause practically complete motor inability. The rat may not even be able to stay on the maze at all. Many errors are made and there is much retracing. Under the circumstance of the repeated injection, at least one hour is required following the second dose before the animal returns to anything like normal. Our experiments have of course been controlled by injecting certain of the animals with saline solution. The animals were injected by one person, then turned over to another assistant who did not know what had been injected, and he observed them and recorded their performance. If the injected alcohol equals as much as 1/1000 of the body weight, it is not difficult to tell which animal has received alcohol and which saline. When the alcohol is 1/2000 of the body weight, identification of alcohol or control animals on the basis of observed performance is not very exact.

In conclusion it may be said that people take alcohol because they want to. It is not universally shunned like toothache and tuberculosis. And while it is ordinarily found to slow up and somewhat disarrange the reflex and voluntary acts of the organism (man or animal), there appear to be some individuals who do not look with marked disfavor on the occurrence of a certain amount of this effect at certain times. The scientific worker is not inclined, or called upon, to decide for or against alcohol. It is his business, within his bit of field, faithfully to reveal facts. The struggles of life will prompt the von Bessings of this and later eras to use these facts and rouse men to conduct based upon them.

THE PHYSIOLOGIC LIFE

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We know today many factors that injure the individual, and a few that seem to injure the race. But in our almost complete ignorance of the mechanisms of race improvement, we seem impotent on the positive side, except that by eliminating those who deviate markedly from the average we may give the latter group more elbow room. By selection and controlled breeding we seem to be able to secure a fatter hog, and a faster horse. Have we thereby secured a better hog and a better horse?

Assuming that we know how to achieve fundamental race improvement, is there any agreement as to the goal? Is the super model of *Homo sapiens* to be constructed on the line of a Mussolini, a Gahndi, an Einstein, a Dempsey, a Darwin, or a Henry Ford? Is he to be "wet" or "dry?" Should he be white, black, yellow, brown, pink or gray? Should he be six or sixty feet tall? Should he be a more rational or a more emotional machine? Is he to be a pacifist or a man fitted to wage bigger and better wars? Are we to aim at a better coordinated society of masters and slaves, or a democracy?

The present state of development of man and his fellow animals has come about through the forces of heredity and environment, practically without an iota of conscious direction based on accumulated experience. The time during which we have had even an approximate understanding of our physiological processes, and the factors that favor or impede the same, is so short that it may virtually be ignored in the total time span that man and other animals have existed upon the earth. If we knew what our forebears ate and drank (and how much); if we knew how they worked, rested, and loved, we could with greater certainty put the labels "favorable" and "unfavorable" on the manner of living and the man-made environments of today.

We may assume that the present man is the best possible product of past conditions. In what respects do conditions of human life today differ from those of yesterday, and do any of the newer conditions bode ill for tomorrow?

THE HABITS OF MODERN MAN

1. Modern man cooks, preserves, sterilizes, and "denatures" his food to a greater extent than his forebears.

2. Modern man lives under more uniform climatic conditions because of clothes, houses, and fire. Also, in consequence of these, he lives less in the open and farther from the sun than did primitive man.

3. As a consequence of industrial developments and the growth of cities, a large proportion of men today are more crowded, more subject to polluted air, polluted drinking water, and industrial poisoning than our ancestors.

4. As a consequence of the growth of knowledge, particularly of chemistry and of medicine, man of today is being subjected to a greater variety and quantity of stimulants and drugs.

5. Because of a greater knowledge of Nature, modern man probably has less fear but more anxiety than man in the past.

6. The sex life of modern man seems ill-adjusted to the prevailing social theory and practice. We do not know, but it seems probable, that the very ancients lived a more biological sex life.

7. In consequence of the growth of knowledge, art, industry and invention, man of today is probably subjected to a more continuous, if not more varied, nerve strain than in the remote past. We have accumulating evidence that excessive brain activity may interfere with some fundamental physiological processes, as a powerful gas engine may shake to pieces a less solidly built chassis.

COOKED AND REFINED FOODS A LATE ACQUISITION

We may assume that our forebears (as well as all other animals in all ages) have from time to time been subjected to quantitative under-nutrition, that is, starvation. In tropical climates this is merely a question of the number of animals, and quantity of available food. In temperate climates it is also a question of seasons. To be sure, many animals have become adapted to the second factor, they have become accustomed to prolonged inactivity and starvation (hibernation), but we have no evidence that man himself ever was a hibernating animal. I think it is safe to say that modern man has reached his present stage of perfection (or imperfection) through periods of quantitative under-nutrition as well as periods of gorging in the presence of plenty. There is no reason to assume that our ancestors, any more than their fellow animals or modern man, refrained from eating far above their actual physiological needs if plenty of food were available. It seems probable that qualitative under-nutrition, that is, diets lacking for a long time in essential salts, essential vitamins, essential proteins, and in essential roughage, was probably less prevalent among our primitive ancestors, because cooking and so-called food refining is a late acquisition. If this is correct, it follows that most of our so-called food deficiency diseases, excepting, of course, those that are brought on as a result of

quantitative starvation, are man-made diseases. I refer to the various pathological processes induced by lack of vitamins, by lack of adequate proteins, by lack of roughage in the food and by lack of proper salts in the food. Man has brought these on himself largely through misguided esthetics and perverted taste, and through commercialism not controlled by physiologic knowledge.

In all fairness we should add that as man is now distributed on the earth, various types of food preservation (sterilization) are a necessity, not only preservation from season to season but such preservation that food may be shipped long distances from one country to another where the density of population is in excess of the ability of the country to feed it. The problem of food preservation and so-called food purification is one of commanding importance to our race today, because in this respect industrial processes and dietary habits of long standing are only slowly brought under control of physiologic knowledge. We still mill our grain and feed the bran to hogs and cattle. This may help to develop super hogs and super cattle, but it is no aid to the physiologic life of man.

ADVANTAGES OF OMNIVOROUSNESS

On the basis of our present knowledge of the physiology of man and animals, the old question of vegetarianism vs. foods of animal origin has little or no merit in fact. There is no doubt that man can injure himself temporarily and possibly permanently by the over-eating of meat as by excessive proteins of any source. Possibly our very remote ancestors were strictly herbivorous; the earliest animals must, perforce, until they turned cannibals, have been herbivorous. But man, as we know him today, can use food of animal origin with impunity and physiological profit. I would say that the more nearly omnivorous the human individual is, the more certain he is to avoid diseases due to faulty diets. Indeed, it would be more conducive to the physiologic life if we set about, through education, to remove the present human prejudices against certain species of animals as sources of food than to keep alive the religious superstitions that some or all foods of animal origin are taboo. I refer to such notions as "clean" and "unclean" animals handed down to us by the laws of Moses, the abstaining from animal food on the basis of "transmigration of souls," the eschewing of certain animals as food because they look repulsive or disagreeable or because they are friends of man. Almost any species of animals, by proper training, can be made the apparent friend of man. If the present trend of rapid increase in population continues, we would contribute more to the physiologic life by teaching universal omnivorousness than by clinging to ideas handed down to us by the ignorant past

or dictated by the whims of imagination. The eel is not a poisonous article of food merely because it has the body form of a snake; the snake itself is not bad eating despite the alleged rôle of the snake in the "fall of man." By omnivorous I do not mean food of animal origin alone; I mean also a much greater extension of the use of the vegetable kingdom. Sailors learned to cure scurvy by a decoction of pine needles, when nothing else was at hand. It is hinted that the eating of grass by Nebuchadnezzar was a "curse of God," while, as a matter of fact, it was a part of wisdom.

ADVERTISING THAT TENDS TO CONFUSE THE PUBLIC MIND

With every new advance in the knowledge of our specific needs for food elements, there blossom forth commercial enterprises whose advertising tends to confuse the public mind. We are to buy vitamins over the drug counter instead of at the grocery store. We eliminate roughage from the food and try to palliate constipation by mineral oils. We are made to believe, by persistent advertising, that we are on the brink of an abyss unless cod liver oil, yeast, nuxated iron, etc., are ingested daily. We identify whiteness or absence of color in many foods with purity and, by inference, wholesomeness of such food articles.

THE PROBLEM OF OVER-EATING AND UNDER-EXERCISING

The problem of obesity in the human individual is largely a question of over-eating and under-exercising. To what extent over-eating may contribute to race deterioration it is difficult to say, because that implies injury to the germ plasm. The possible injury to the individual is of little racial significance.

If we survey the animal kingdom as it exists today, it seems by and large that except for the play of the young, the only exercise taken is that rendered necessary for the securing of food and the propagation of the species. Of course, in all animals living in temperate or colder climates, cold itself, for the warm-blooded animal like man, is efficient physical exercise. But when not driven by hunger or sex, most animals (including man) are lazy. It is highly probable therefore that man has reached his present state of development on the basis of exercise largely determined by physical necessities. This rule still applies to the majority of humans the world over. The majority have no accumulated food reserves. Most of us have to do physical work every day for a living. The problem of race deterioration from physical inactivity applies, therefore, only to a small portion of society, the so-called well-to-do, who can through their wealth command the satisfaction of most needs without individual physical exertion. There is no question, in the case of many of the body organs, that a certain

amount of atrophy and deterioration follows in the wake of disuse, and consequently, that activity, however caused, is within limits beneficial. But does such physical inactivity cause deterioration of the germ plasm? And at what point does excess of physical work lead to germ plasm degeneration? Biology has as yet no answer to these questions.

THE INFLUENCE OF CITY LIFE

The only abodes of our most ancient forebears that have survived to historic time are natural caves, but even assuming that humans were not very numerous in those days, I doubt whether there were caves enough to house them all. And it is not unlikely that our forebears lived in trees for some time before they stepped down into caves. The caves of our forebears were probably no more healthful than modern apartments. Some type of hole in the ground or on the ground seems necessary as a protection against the rigors of climate. But modern industry demands and creates these holes in ever increasing numbers and in horizontal layers. The influence of city life on the race is a large problem, without an answer as yet. It is a question not only of sunlight and pure air, but of crowding, of infections, of immunity, noise, glare, mimicry and exhaustion. A place under the ultra-violet lamp may be a safe substitute for the place in the sun. Many species of animals have not only survived but apparently made continued progress in almost total absence of sunlight. I do not refer to animals living permanently in caves, because in many of these we see some signs of degeneration, probably because the cave of life has been adopted too suddenly, but I refer to animals that during the day live in caves or holes in the ground and hunt for their food during the night.

Pollution of air and water by modern cities and modern industry is on the increase, and the probable danger from these conditions seems only partly appreciated by society. Formerly, lead poisoning was largely confined to workers in lead industries. Now lead is blown into the air from the exhaust of nearly every automobile. Lead and arsenic are taken into our system with the apple and pear. We may not inhale enough lead in our breathing or consume enough lead and arsenic in our fruit to produce acute poisoning and tissue injury, but who is there to say that this slow assimilation of metallic poisons brought about by modern industry is without danger and ultimate injury? The only factor of safety that I can see in this situation is the phenomenon of tolerance, that is, the capacity of the living organism, if it is not seriously wrecked by the poisons, so to adjust the internal processes as to render the poisons less and less injurious. Tolerance

means physiologic compromise, but such continued existence does not necessarily mean the higher life. Continued increase of population means increased growth of cities, increased industrial concentration, and increased industrial poisoning, despite all measures to eliminate the latter.

THE NORMAL SEX LIFE

One of the fundamental physiological processes, which at present seems to be out of adjustment to a greater extent in man than in our fellow animals, is sex life. We are not agreed as to what is the normal sex life of modern man, but ethical leaders in all races have on the whole tended to the view that sex activity should and can be repressed or consciously controlled by the individual or society to a greater extent than the urge of hunger and thirst, or the call for evacuation of the bowels. In many, if not most, animals the essential sex urge is seasonal and closely associated with reproduction, and as a rule the reproductive processes in animals start with sexual maturity and continue throughout the sex life of the individual. In most parts of the world, human society is now so organized and human habits fixed in such a way that approved sexual intercourse cannot start with sexual maturity in our children. This means a long period of sex repression, "illegitimate" sexual intercourse, or perverted sex practices. It is held by many, though in most cases physiologically unproved, that these three sequelae of our modern social orders as related to sex life are injurious to body and to brain. The physiologist may view the mental gymnastics of the Freudians with wonder, but he is not in position to state that the present social practices as to sex are the best possible for the present or future of the race. The physiologist is puzzled by the evidence in modern man of a sex drive in excess of the need of reproduction. He is aware of the speculation that the sex drive means more than reproduction, that it is the basis of all progress in inventions, in art, in warfare, in practically everything in which modern man seems to have exceeded the ancients. If this is the case, the physiologist should not concern himself with the means of controlling or delaying the sex urge. The solution is birth control. The greater continuity and persistence of the sex urge in man than in most of the other animals may be related to the greater brain development (memory, imagination). If this is correct, we have here an instance of uncorrelated development, that is, development of one organ or process leading to discoordination or injury of another.

STIMULANTS AND NARCOTICS INJURIOUS

The indulgence in narcotics and stimulants antedates chemical knowledge, but chemistry and commerce have greatly enlarged the

field. We not only isolate and concentrate new drugs from plant and animal tissues, but almost every day records the synthesis of new drugs in the laboratory. Individual and organized greed extends the facilities for drug addiction.

Do not expect me to say anything new and true on the alcohol question as related to Race Betterment. People have imbibed alcohol in the past, have lived, and reproduced. It is not difficult to prove the deterioration of the individual, and in some cases the offspring, by excessive alcoholic indulgence. Man appears, by and large, to be the only animal with the alcohol habit. All human races can become alcohol addicts unless checked by ethical considerations. "Tolerance" to alcohol has not yet been acquired by the race as a whole. Alcohol may be indifferent in race improvement, but if the issue is forced today, the physiologists must vote against alcohol, on the basis of probable injury.

No word can be said in defense of the other narcotic or stimulating drugs. Their influence on normal life seems to be uniformly injurious, except possibly in the direction of protection of the brain against the over-stimulation and over-fatigue of modern life, and this applies also to alcohol. There are instances from experimental laboratories of morphine or other drugs protecting the brain or parts of the brain from fatal effects of such stimulation or from otherwise fatal effects of poisons.

I know of no evidence that the alkaloids of coffee, tea, and tobacco improve the individual or the species. Whether they are factors leading to race deterioration is an open question. Many people believe that this is the case, but belief is not knowledge. Some weight should be given to the fact that during the period that many humans have indulged in these substances, man has made rapid progress in externals, but this progress may have been made despite this indulgence rather than because of it.

POISONING FROM FOOD PRESERVATIVES AND FOOD SUBSTITUTES

Modern chemistry has opened up another avenue of poisoning for the human system through the field of food preservatives and food substitutes. We have the problem of the harmfulness or the harmlessness of the various baking powders; of benzoic acid as a permissible food preservative, of saccharine as a substitute for sugar, etc. Many of the experiments purporting to prove the permissibility or harmlessness of the substance or preservative, even those carried out by competent scientists, seem to me wholly inadequate. I have in mind as an example the experiments and findings of the Remsen Consulting Board on the question of saccharine in foods. Under the direction of this Board, composed of leading biochemists and chemists, varying quan-

tities of saccharine were fed to a small number of healthy young men, daily, for periods up to nine months. The Board concluded that the daily ingestion of this food substitute below a certain quantity (.3 gram per day) is without injurious effects; above this saccharine produces injury. This conclusion became a guide to federal legislation and regulation. Was the above conclusion warranted by the experiments performed? We think not. All the experiments proved was that the substance (saccharine) when taken by healthy young men over this period did not produce any injury that the Board could detect by the tests used. Society is composed of individuals other than healthy young men, and nine months is a short period in the span of human life. There are many deviations of physiological processes that cannot be detected by body weight, food intake, or the chemical examination of the urine. Most of the organs in the body can be injured a great deal before we become actually sick. It would seem a safer principle for governments and society to insist that the burden of proof of harmlessness fall on the manufacturer or the introducer of the new foods and food substitutes rather than on society to show its harmfulness, and the test of the harmfulness or harmlessness should involve all physiological processes of man.

THE INVISIBLE ENEMIES

There are people who believe that the future progress of the human race will be measured by our success in eradicating infectious organisms (preventive medicine), and in such complete understanding of physiological processes as to enable us to control the processes of immunity. Paleopathology furnishes no conclusive evidence that races or species now extinct were slain by infectious diseases. Far be it from me, as a worker in one corner of the medical garden, to minimize the importance of medical science both in the preservative and in the curative aspect of Race Betterment. But I cannot see how mere prolongation of the individual life span or mere multiplication of human individuals will enhance human evolution. Indeed the reverse argument is not easily met, namely, that medical science today helps to deteriorate the race by helping the biologically weak to survive and to reproduce. Knowledge of the processes of immunity sufficient to enable us to augment this factor in the individual, apart from what we already know in a general way of hereditary strain, improved nutrition, and hygienic surroundings, seems far afield; but, again, it may come faster than the most optimistic prediction.

An eradication of infectious organisms or complete control of the individual infection by chemotherapy seems utopian. The scientist who ventures prophesy today has a good prospect of being shown up a fool tomorrow. But it seems likely that the human race will survive

(and in fair shape) all now known infectious organisms, not by the process of eradication, or scientifically controlled immunity, but by the process of tolerance and symbiosis. Whether this prospect is cheerful or abhorrent depends on whether or not the symbiosis involves surrender of any essential element of further evolution of our species.

CLIMATE AND RACIAL EVOLUTION

Some one has remarked that our planet is better fitted for pisciculture than for human culture, since water covers the greater arc of the earth's surface. The cradle (or cradles) of the human race is (or are) not yet located, hence the climatic conditions of early human evolution are among the many unknowns in the process. But today, man (as well as the rat, the body louse, and the English sparrow) covers practically all of the land, so that we have all the possibilities for favorable and unfavorable evolution as far as these are conditioned by climatic factors alone. This gigantic experiment in human ecology is, however, becoming increasingly complicated by man-made modifications of his environment. We have scarcely made a beginning in the study of the influence of climate on human physiology. The sporadic appearance of the externals of human culture in diverse places of the earth in the past is probably not primarily a matter of climate. Heat and humidity can be depressing on some physiologic processes. Because of the factor of basal metabolic rate, man is less able to adjust to the extremes of heat and humidity than to extreme cold. We know some of the favorable effects of sunlight (e. g., bone growth, killing of bacteria), we have hints of unfavorable effects on the blood, the blood pressure, the retina, and the skin. The latter may not be fundamental and there is no evidence that the germ plasm is unfavorably influenced.

We know something of the favorable and unfavorable influence of diets, behavior, natural and man-made environments, poisons, etc., on the physiologic processes of the individual. But this is merely limiting or permitting full development of individual growths and functions. Unless these factors modify the germ plasm (rapidly or slowly), they are not significant in relation to Race Betterment. The only clear instance we have of rapid modification of the germ plasm by experimental (drugs) or environmental means seems to be injurious or destructive. Man today is a curious, clumsy, and very ignorant child destroying the watch. Will he, tomorrow, contrive a superior mechanism? The lesson for the present seems clear: *The germ plasm can be injured. Some phases of the present man-made environment seem to enhance such injury.* Are the ablest, the strongest, the wisest merely grave diggers in disguise? Is it possible to detect the factors and abort the danger, so that man himself may not deflect or impede the river of life?

SOME NEW PHYSIOLOGIC DATA AS A BASIS FOR MORAL HYGIENE

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PHYSIOLOGICAL PART

Investigating the reflexes of salivary glands produced from the oral cavity, the author discovered that all reflexes could be sharply divided into two distinct groups, which are controlled by entirely different laws. The first group is composed of the reflexes from *pleasant* (useful) substances, the second from *unpleasant* (harmful) substances. Reflexes of the first group diminish in strength at frequent repetition; reflexes of the second group on the contrary increase through frequent repetition.

During the interval in action in both cases the reflexes tend to return to the initial value, the longer the interval the stronger the restoration.

The change of the stimulants in the first case acts as the interval in the action—a new stimulant after a series of previous ones manifests its full strength; in the second case the change of the excitor has no significance. The mentioned opposite changes in the work of the glands, at pleasant or unpleasant excitation, are extended not only on the quantity of the secretion, but also on its properties. For instance, at frequently repeated feedings with the same pleasant food, the quantity of saliva as well as its organic contents strongly and constantly decrease. In the case of the gastric gland the findings are quite similar.

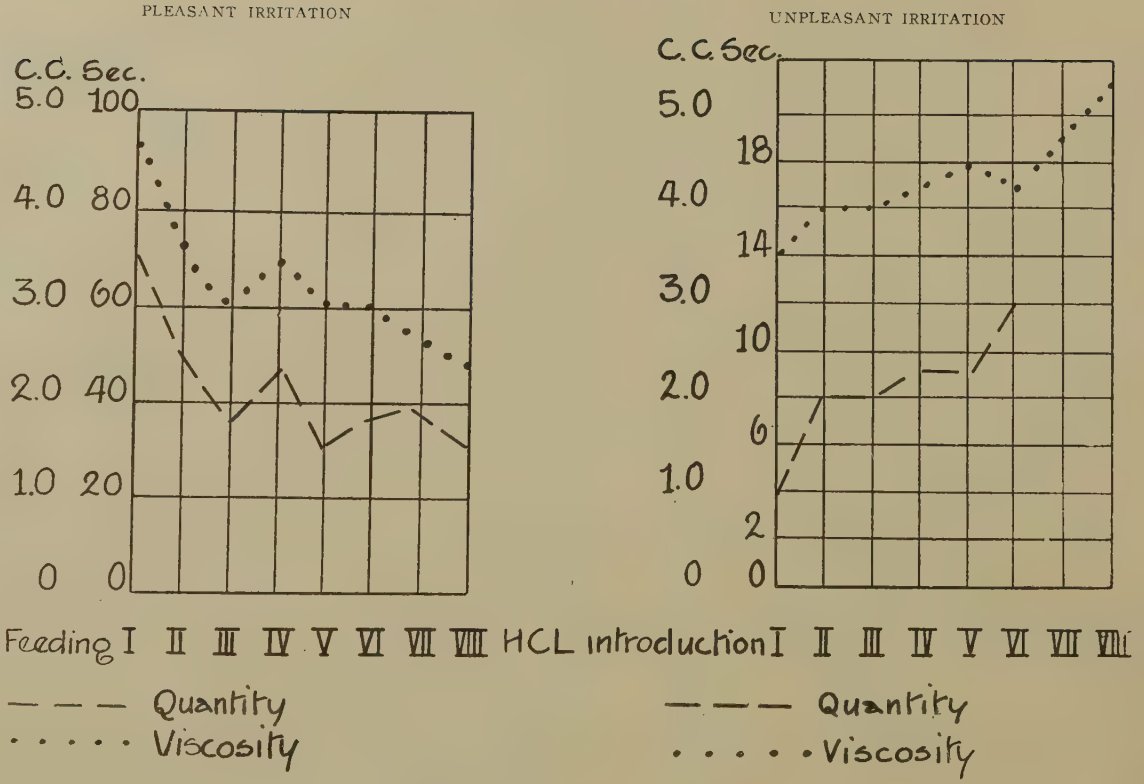
These data are formulated by the author in the form of two laws.

1. *Frequent repetition of pleasant (useful) irritations decidedly lessens their action respecting both quantity and quality of saliva. A long interval between the reception of such irritations restores their action. The weakening of the action of irritations caused by the repetition of one pleasant irritant does not influence the effect of other similar irritants that may be employed thereafter.*

2. *On the contrary, with the frequent repetition of unpleasant excitations, the quantity of secreted saliva (or tear) and its organic contents strongly and constantly increase.*

In the case of frequently repeated introduction of the same quantity of unpleasant (or injurious) substances into the mouth, the secretion of saliva increases both in quantity and in quality. An interval between experiments reduces the secretion to its original conditions.

SALIVARY SECRETION



Numerous experiments made by the author in Russia, Japan and America, many times demonstrated publicly, showed that the two laws established by him are extended also on other than digestive glands (lacrimal and sexual), namely, on the glands which are under control of the cortex of the brain. The removal of the brain cortex does away with both of the mentioned laws. They are, therefore, directly dependent on the cortex of the brain.

Since during the already mentioned physiological processes parallelly and in a direct ratio the psychical processes take place, it is quite apparent that the two aforesaid laws (of excitation) regulate also these psychical processes. Experiments of Dr. Krasnogorsky and others proved that the findings of the Pavlov School, concerning the work of salivary glands under the influence of cerebrum, are entirely applicable to man. The laws of excitation must, therefore, be extended also on man.

PSYCHOLOGICAL PART

It has been established by works of German, Russian, English and American biologists that many physiological phenomena, especially reflexes, are wholly reflected in the psychical sphere of men and animals. Thus, the physiological laws of the cerebral activity may be in a certain degree applied to the study of purely psychical phenomena

The author has attempted to apply to the psychic realm the two laws, discovered by him, regulating, through the brain, the activity of various organs of our body, and to watch the effect of these laws on the everyday phenomena in human life.

The author finds that *all* psychic phenomena should be classed in two contrary groups: 1. Useful or pleasant process; 2. Harmful or unpleasant.

The first, in frequent repetition, lose their power; and with an interval they are restored, the more so, the longer is the interval. A change of such phenomena by another of the same kind, more pleasant (useful), acts like an interval.

The second, in frequent repetition, are growing in power and may reach the stage when they become extremely harmful for the organism. *A change of irritations does not affect the matter, contrary to the first law.* Only a long interval restores the organism to the normal.

Therefore, for the two groups of phenomena, entirely different, even contrary in their essence, Nature has established one general rule: An interval in reception of both kinds of phenomena is necessary; in other words, *temperance* should be the basis of our behavior.

Breaking away from this rule involves, in the first case, satiation with all its consequences; and in the second case, premature exhaustion

of our organism—i. e., premature bodily and spiritual old age and even possibly an early death.

The author's researches suggest that both laws be kept in mind in the pedagogical field, in the jurisprudence, etc. They are important in the human life from different points of view (in the problems of the cause of sleep, of rejuvenation, of use of narcotics, and so forth).

NATIONAL NUTRITION AS A FACTOR IN THE DEATH RATE

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Do you know the most sickly animal of the world? It is a certain two-legged animal called "homo sapiens"—the wise man. After man comes the domestic animal and last the wild animal. I have recently been studying a large German book about the diseases of wild animals, and have found that these sometimes suffer from diseases caused by parasites, poisonous herbs and external injuries. But all these common diseases of the intestines, liver, kidneys, brain and blood vessels that kill man at the age of fifty or sixty—these do not seem to be found in wild animals.

It seems, also, that such diseases are very little known by Nature people, outside civilization. Time will not allow me to tell what Dr. Carrison, Dr. Azemocer and others tell us about this matter. I suppose you know that diseases I have mentioned are diseases of civilization.

I think that it is much easier to prevent these diseases than it is to prevent infectious diseases, but, curiously enough, the medical profession has learned to prevent epidemic diseases while, as a rule, it has not learned to prevent the organic diseases. On the contrary, the medical profession has even induced people to get these diseases.

Medical science has, as you know, been built upon mistakes, one greater than the other. But the greatest of all is the mistake about the diet, especially about the good proteins. What you call good proteins, I call bad proteins. It is very interesting for me to see that Dr. Louis H. Newburgh, of the University of Michigan, has come to the same result.

EXPERIMENTS ON MAN TO FIND THE BEST DIET

I am now 66 years old. The last 33 years I have spent in finding the best diet for man. I have specialized in experiments with man. You use rats. Of course if you want to find the best diet for rats, I agree that it is wise to use rats, but if your intention is to find the best diet for man, I suggest that it is better to use that supreme being.

Why have you not used men? I suppose the reason is that you have not been able to find men who would offer their bodies for such experiments. It is, first, not fun to live one year alone on potatoes and margarine, and in this year, day after day, to control not only the food but also the urine and the feces. It is the life of a slave. I myself have lived this way for months, but my assistant, Fr. Madsen, has lived this way for seventeen years, and others have done the same for many years. It is to such heroes that I owe my results.

Thirty-three years ago I and my whole family began to live on a low protein diet. On such a diet I have brought up my four children, all unusually strong and healthy. Ten years later I began my public propaganda for a plain, mostly vegetarian, diet. Time will not allow more about that. But my work aroused a great sensation, mainly because I lived so very cheaply—seven cents a day. In 1910, the Parliament, as a kind of reward, gave me a laboratory. I can here only mention some of my laboratory experiments. This paper can, of course, be only a very short summary. In Danish I have sent out 25 reports.

THE VALUE OF THE POTATO

Let us begin with *potatoes*. Previous to 1912, when we began, the value of potatoes as food for man had never been tried in a laboratory under scientific observation. It seems incredible, but is nevertheless true.

Now, to try the value of potatoes one cannot eat potatoes together with a lot of other foods. It is necessary to try living for a long time on potatoes alone, or at most with the addition of such a neutral ingredient as vegetable margarine. Such a long test with a single food has never been tried before. I think it had never come into the head of a scientist that a man could live a year on potatoes.

In January, 1912, two other men and myself began to live on potatoes and margarine. I did not think it would succeed, but I wanted to see what would happen on such a hunger-diet. Afterwards, I would try how much meat or eggs there ought to be added to get enough of protein. The most remarkable thing was that nothing happened.

As an example, I will mention my assistant, Fr. Madsen. He lived for six months entirely on potatoes, margarine and water. He is a gardener by profession. He works from eight to three in the laboratory, but in the spring and summer he rises at three or four in the morning and works in gardens, and again from three to ten in the afternoon. He not only works, but he does twice the work of others. He used five pounds of potatoes and five ounces of margarine, and was all right. In the fall I sent him out in the country as a farm laborer. During the three months there, he worked fourteen hours or more a day, the only difference in his diet being that he increased his potato ration to eight pounds and his margarine to eight ounces. As shown in our report, his working power was unusually great. Once he worked continually through two days and one night, pausing only for an hour and a half to eat his potatoes.

These experiments have since been repeated in Germany by Prof. Abderhalden in Halle. He wrote, "There is no longer any doubt that it is possible to live on potatoes alone. The potato is a complete nutriment."

Also Professors Hochhaus and Koster in Cologne made experiments with a pure potato diet. They wrote, "Our experiments fully confirm the correctness of the statements of Hindhede." "One has to let his calculation stay as a fact, according to which a pound of potatoes has the same nutritive value as a pound of lean meat."

We did not only live on potatoes, but we lived on potatoes with an abnormally low protein content. We were able to get protein-balance on 23 grams of digestible protein.

THE POTATO NOT ONLY A FOOD BUT A REMEDY

The potato is not only an excellent food, perhaps the best of all, but it is a remedy, it dissolves uric acid as well as lime and is therefore able to cure different forms of gout and of rheumatism. I have seen many examples. If you send your patient to an alkali-well, or if you give him plenty of potatoes, the result will be the same. But the potatoes are the cheaper.

But when you will try to live on potatoes, you must not forget also to drink the water in which the potatoes were boiled, as many vitamins and salts are found therein. If you give the water to your chickens they will not come to suffer from beri-beri, which often happens with the chickens. But you dare not give the same water to the hens, because the egg shells then sometimes are dissolved.

THE STRENGTH OF THE IRISH POLICEMAN

You have heard about the Irish and their potato-bellies. In 1926 I made a visit to the western part of Ireland. I found there the poorest people I have ever met. They lived mostly in primitive rubble-huts without floor and without ceiling. I had dinner with them, a dinner that consisted of potatoes and of potatoes alone—without butter, gravy or bacon. We were only offered some buttermilk to drink with it. The evening meal was usually the same. In the morning and afternoon they had bread, a little butter and some strong tea. The same every day. On this diet I found the strongest and healthiest people in the whole of Ireland, and I believe in the whole of England.

In the year 1900 the death rate was far lower in Ireland than in any other European country. In Dublin they take policemen mainly from the potato districts. Dr. Hooper, Director of the State Department in Dublin, has, at my instigation, made researches in ninety-seven of the poor districts, and has found that, as a rule, the death rate decreases as the amount of potatoes grown increases. When, in the year 1910, I was in Washington, I asked an expert in nutrition, Dr. Langworthy, how it was with these Irish and their potato-bellies. He laughed, and answered, "Look at our policemen, they are all Irish. We take the Irish because they are the strongest."

The potato is perhaps the most healthful and the cheapest of all foods, the food that per acre gives the most nutriment. But, in Denmark, this admirable food is fed mostly to the pigs!

I am called the potato-doctor, in Denmark. But all admit that I have made the Danish people eat more potatoes. So much for the potato.

A HUMAN EXPERIMENT WITH BREAD

In this experiment two of us lived for eight months on very coarse whole-wheat bread and vegetable margarine. On this diet we felt unusually well. Then we tried to live on ordinary white bread, but after three weeks we felt so weak and dizzy that we were scarcely able to walk. Now what is the difference between whole-wheat bread and white bread?

The difference is the bran. Bran is one of our very best foods. It contains the best kind of protein. Besides all the vitamins and the most of the minerals (lime, phosphate and iron) of the wheat, bran protein can replace meat, egg and milk protein. This fact has been pointed out by Dr. D. B. Jones at the protein laboratory in Washington. But this very best part we, of course, give to our cows!

Some scientists maintain that man is not able to digest bran. Our experiments have shown that this is not true. Man digests bran even better than pigs do, and almost just as well as cows. Other scientists, as Prof. Wiegner in Zurich and Prof. Johansson in Stockholm, have since tested our results and found them correct.

Of course one-third of the bran goes out undigested. But that is even the greatest profit; that gives movement. Meat and white bread give constipation, a very dangerous disease.

Your millers are very clever. They sell fine white flour at a high price, causing constipation, and bran at a still higher price, to cure it. Whole-wheat or whole-rye bread can be produced, of course, much cheaper than white bread. In Denmark, whole-rye bread costs only half as much as white bread. When it costs the same here, it is because it is not commonly used.

THE COMPARATIVE VALUE OF WHEAT PROTEIN

It is not necessary to add meat or eggs to whole-wheat or whole-rye bread in order to get enough protein. Fr. Madsen, whom I have mentioned, could get balance on 47 g. of digestible bread protein. We were not able to get lower on bread alone because it contains so much protein. But is this a minimum? To try to get lower we must add protein-free foods. Besides more fat, we can add sugar and starch. In this way others got down to 20 g. of protein, but after two weeks they did not feel well; they lost appetite, and felt nauseous. They thought, then, that this was caused by too little protein. But that was

a mistake. The trouble was the bad composition. White bread and sugar and starch contain no vitamins.

We found a better composition: To whole-rye bread we added prunes cooked together with sugar and starch—prune porridge as we called it—a dish that is much used in Denmark in the summer. In this way we succeeded in getting down to 22 g. of protein net. Two men lived on such a diet half a year and felt very well. Their working power was—as shown by test—unusual. One of the men walked, after finishing, 262 miles in four days and without training before.

That proves that 22 g. of rye protein is enough, or that rye protein has the same value as meat and milk protein. A very significant result. Only short experiments or experiments with bread without bran have given different results.

ENDURANCE INCREASED ON LOW PROTEIN DIET

All in all I maintain, on a basis of thirty years of experimentation, that a diet poor in protein does not decrease but, on the contrary, increases the endurance. That is quite the same as found by Chittenden and by Irving Fisher at Yale. But it is difficult for people who have never tried it to believe. I know myself how difficult it is to free one's self from old ideas.

THE BARLEY STORY

In this experiment two men lived for six months on barley-porridge, sugar, vegetable margarine and water. One of the two men was sick at the beginning. He had for a couple of years been suffering from indigestion, was thin and looked bad. After finishing, his indigestion was cured, he had increased 22 pounds in weight and he looked well. The other man felt very well the whole time and had an excellent working power.

The wife of a Danish teacher told me the following:

At the beginning of the War her husband had lost an extra income. Her funds were not sufficient, therefore, to take care of four children—of ages from ten to sixteen—who were strong eaters. So, she told them to eat much of the first course, porridge, because they would not get much meat at the second course. But she could not make the children do it. Then she started to serve nothing but barley porridge four days each week. This taught the children to eat porridge. And the result was that, after some months, they looked much better. The wife continued: "Also I myself look better. My husband tells me that I never have been so nice before." Is it not remarkable that barley grits—peeled barley—can be such an excellent food?

When guinea-pigs feed on barley only, however, they die from scurvy in four weeks. And I must add that when we took away the

margarine and lived on barley and sugar alone, the result was quite different. The men lost in weight, lost appetite and did not feel well.

What's the matter with the vegetable margarine? We read always that this food does not contain vitamins at all. According to our very long experiments with different cereals plus vegetable margarine, that seems not to be correct. We must remember, also, that the coco-oil is churned with milk and that a little egg-yolk is added as a rule. From this must come a small amount of vitamins (A and C). This seems to be sufficient for adults, who, in contrast to the small animal, need little of this vitamin. Children need more, but it seems that children may get ill from too much A vitamin. That is the experience of Dr. Monrad, Professor and Director of the Children's Hospital in Copenhagen. He has reported about 350 children who got ill through feeding with too much butter, whole milk, cream and eggs. They were meager, slack, tired and anemic. As soon as these foods were taken away and they were given instead skim milk and vegetable margarine, the children got healthy, got red cheeks and increased in weight. When Monrad was told that I intended to go to the United States, he said, "Tell them that they are vitamin crazy." Do not forget that I do not maintain that all children get sick through much butter, cream and milk, but for some it is the case.

I suppose that in countries where white bread is the staff of life, it is wise to give a good deal of milk, but I doubt that the same is the case in countries like Denmark, where we use much whole-wheat bread.

AN EXPERIMENT WITH OATS

Two men lived eight months on oats, vegetable margarine and sugar, and felt excellent.

It is very surprising to some that these men, who lived for years on cereals and margarine, did not get scurvy. I would not, of course, recommend such a diet, as I suppose that some would get the disease, but that would be easy to prevent by adding potatoes.

WAR FAT-STARVATION CAUSED BY SWINE

How much fat do we need? was a very burning question during the War. In 1916 we tried to find a diet without fat that it would be possible to follow for a lengthy time. It was not easy. After many tests, we found that a diet composed of cabbage soup with potatoes, eaten together with bread—mostly whole grain bread—was a good composition. Now, how long do you believe it possible to exist on this composition? I don't know, but two of our men followed this diet closely 835 days, or more than two years. The only variation was that in the spring they sometimes had rhubarb-soup and in the autumn sometimes apple-soup, instead of cabbage soup. The men always felt

well. Fr. Madsen increased 20 pounds in weight in the first 9 weeks of this experiment.

When in 1918 I published these results in German, I drew the conclusion: *"Fat is not necessary. Greens can replace fat."*

The German physiologists thought I was crazy. But then a year later Mendel showed that spinach and carrots can replace butter in feeding rats. Now all believe. It is not the fat but the fat-vitamins that are needed, and these are found in greens as well.

This is a very significant result. It solves for a time the question of over-population. If animal production were wholly given up and people lived alone on bread, porridge, potatoes and vegetables, Denmark could produce food enough for twenty million, Germany for two hundred million and great Britain for one hundred and thirty million people. Now Great Britain imports most of the food for forty-five million. United States and Canada could, I suppose, produce food enough for half the world.

You remember that ten years ago hundreds of thousands of people in Germany were "starving." They did not need to starve; they starved from superstition. Science should have helped, but it did quite the contrary. In 1915 I wrote an article about nutrition in a German paper. I closed with the following: "The Germans know that they fight against three great powers, but they do not know that also they fight against a fourth, more dangerous than the three, namely, the German swine." I was right. It was the swine that caused the starvation, caused the desperation, caused the dreadful submarine war that brought the Americans to Europe. (See Table 3, page 396.)

THE TRIAL OF A FRUIT AND NUT DIET

According to the structure of the teeth, man seems to be mainly a fruit-eater. We tried for about five months to live alone on fruits—apples, pears, bananas—and on nuts, but curiously enough Fr. Madsen, who was a strict vegetarian and who therefore thought beforehand that this would be an ideal diet, was forced to change his mind. He and his comrade did not feel so well on the fruit diet as on the simple bread, potato or oats diets. One cannot live on apples and pears. Bananas in Europe are not the same as bananas in the tropics. Madsen also spent considerable time in masticating the necessary nuts.

A fruit diet may be good in the tropics where one has a great many kinds of fruits, but not in Denmark. Also, a fruit diet is very expensive, and why induce people to live on fruits alone when it does not give so good a feeling of well-being as the plain and cheap bread-potato diet. Fruit can be, however, a good addition. A diet of bread from sifted rye and margarine plus tomatoes gave an excellent result.

A LEAN MEAT DIET FOUND POISONOUS

We also tried to live on meat alone. But when we had lived on lean meat cooked or roasted three times a day, in only three days we were so ill that none of us would continue. What was the cause? Well, when the intestines are filled with lean meat, putrefaction occurs, and the result is diarrhea with very badly smelling feces. Through this process are likely produced toxins, which after absorption cause poisoning. A pure lean meat diet is poisonous for man, there is no doubt about that.

But this does not prove that a certain small amount of meat is poisonous. When together with meat great portions of cereals and potatoes are given, acid bacteria are produced that kill the bacteria of putrefaction. I suppose that it is best not to eat meat at all, but this I am not able to prove, and it is a principle of mine not to make claims that I am unable to prove.

How much meat different persons may endure without getting ill probably varies, but that many people eat more meat than is good for them is proved through the numerous diseases of digestion that are cured through a vegetarian diet. All doctors know that. Such patients are always put on a vegetarian diet and are cured. When they go back to meat they again get sick. What is said about meat also holds good for eggs and partly for milk. Milk seems to be a good food for many, but not for others who get indigestion from it.

THE BEST DIET

As white bread seems to be the main staff of life here in America, I think that milk is a good addition, but if you changed to whole-wheat or whole-rye bread and more potatoes, I should not think that milk would have much effect.

Of course it is not my intention to induce people to live on potatoes alone, on whole-wheat or whole-rye bread alone, or on barley alone. These diets were necessary for the scientific determination of the values of the different foods. But when one can live on any one of these foods alone, a mixture of all is still more likely to give a well-balanced diet.

As a result of all my studies and experiments, I draw the conclusion, therefore, that the best diet should be composed mainly of *whole-wheat or whole-rye bread, barley, oats, potatoes, butter* (*or margarine*), some *green vegetables* and some *fruits* as relish.

I have not been able to find that it makes any difference whether or not in addition we give a pint of milk. We have found that three of the very best foods we have are potatoes, barley and bran. But such food the Danes are foolish enough to give to the pigs and cows. When

the pigs have wasted 80 per cent of the nutrients, and that the very best, as for instance all the vitamins, then we eat the pigs.

My experiments were conducted with only two men at the same time. It would have been better, of course, to have had more men, but it is easier to catch a rat than a man for such purposes, not talking about the difference in expenses.

HOW DENMARK'S DESPERATE SITUATION WAS CONVERTED INTO A DEATH RATE REDUCTION

In 1917 I got a unique chance, however. The Danish Sovereign asked me, in conjunction with Prof. Mollgaard, to plan the rationing for Denmark during the war blockade. This blockade was enforced in February, 1917. The Allies would not allow us to import foods on account of a possible sale to starving Germany. We came into a dreadful situation, which perhaps would be difficult for you to understand. You may think that it would be easy for us to get food enough because we have a very large animal production, but you must not forget that more than half of this production is based on imported foods.

Denmark normally grows forty-four million bushels of rye, wheat and barley. It imports sixty million bushels, which makes a total consumption of one hundred and four million bushels.

Then the sixty million bushels were stopped, and on account of the drought we lost twelve million bushels of our normal crop. We had only thirty-two, and would need one hundred and four million bushels. The situation seemed desperate and it was not consoling that the Germans were starving, although they normally raised about twice as much rye and double as many potatoes per million inhabitants as Denmark.

It seemed desperate, but the solution was nevertheless extremely simple. The fact merely was that both people and pigs could not live. In Germany the pigs were allowed to live and therefore the people died. In Denmark we killed our pigs and lived directly on the pigs' food—their barley and potatoes. We took all the wheat bran from the cows and put it in our whole-rye bread. The half of our bread consisted of bran. Moreover, we took the grains from the distillers, which left us without brandy and whisky, while the English deprived us of our coffee. Some doctors were angry and wrote that Hindhede put the people on pig-food, hen-food.

Yes, I did. It was my intention to put my people on pig-food, a natural diet, to show how foolish we humans have lived.

The whole country was placed on a low-protein diet. Believers in high protein suggested that the resistance against disease would de-

Frederick Madsen, Hindhede's assistant, who has lived for years on low protein diets.

crease. My expectations were to the contrary. Who won? Well, the result was a great victory for the low-protein diet. The state of health improved as never before. The doctors lost their business. The death rate went down during this period of rationing—October 1, 1917, to October 1, 1918—to 10.4 per 1,000, the lowest known death rate of any European country at any time. The total deaths in our little country during this time was 6,306 lower than the year before the War, when the death rate had been the lowest ever known before in Denmark.

(*Dr. Hindhede showed a long series of lantern slides, among which were pictures of his father, whom he credited with having given him his first lessons in simple living, and pictures of his four children and two grandchildren, all splendid examples of the efficacy of the simple Hindhede diet. Pictures were shown also of the individuals used as experimental subjects in the different dietary researches discussed. Among the latter was Frederick Madsen, who has for 17 years been living on the monotonous diets described. He does not appear to have suffered, but on the contrary, exhibits unusual physical vigor.*)

Alfred Jorgensen, one of the test subjects, who lived a year and one-half on potatoes, during which time he trained to be a runner. Before this time he had not been able to run because of palpitation of the heart.

THE STORY OF EDEN

We come now to the garden-settlement, "Eden," by Oranienburg, twenty miles to the north of Berlin. Here, thirty years ago a group of vegetarians bought some land. The land was divided in parcels of three-quarters of an acre. The fundamental principle was to get away from the artificialities of life and back to Nature; from the city to the country. Every man has his piece of land and lives largely from his own garden products.

Living in Eden is very cheap. The resident does not own his garden; he is only a tenant. He pays a very small rent. Before the War it was only about $5.00 a year per parcel. The prices of the land cannot rise. They do not have any very expensive roads and sewers. Sewers are not at all necessary in a Garden City. The feces and wastes are made into compost and used for the garden. The water is poured over the beds. The whole thing is very simple. Sewers in a garden settlement are not only not necessary, but a great waste.

The health in Eden has been unusually good. They have their own school. During 30 years not a single child of school age has died. The death rate of children for the first years of living was only a fourth of the average for Germany. Further details concerning the children from this settlement are given in the following table:

TABLE 1

WEIGHT OF CHILDREN IN KILOS AT DIFFERENT AGES

AGES.....	2	3	4	5	6	7	8	9	10	11	12	13	Aver.
Amer. Norm, Holt.....	12	14	16	18	20	22	24	26	29	31	35	39	24
Dan. Norm, Monrad.....	12	14	16	18	20	22	24	26	28	30	33	36	23
Eden by Berlin.....	13	16	16	19	22	23	24	34	30	33	34	36	25

AVERAGE CONSUMPTION IN GRAMS FOR 18 RESEARCHES IN EDEN, 1921-22. FAMILIES WITH CHILDREN

Eggs Cheese	Margarine	Milk	Bread	Sugar	Fruits	Vegetables	Potatoes
13	51	304	468	59	463	320	579

CONSUMPTION OF PROTEIN IN EDEN PER MAN-UNIT. FIVE FAMILIES WITH CHILDREN

Protein in all, gr.....	62	63	67	82	68	68
—animal	7	13	7	15	15	11

OUGHT TO HAVE CONSUMED ACCORDING TO HOLT

Protein in all, gr.....	122	115	123	138	121	124
—animal	73	69	74	83	73	74

The diet of the Eden children included only one-seventh of animal protein, and six-sevenths of vegetable protein, but they looked very healthy. Besides the fact that in 30 years in Eden not one child of school age has died, do not forget that the children developed during War time.

WHERE THE POOR IMPROVED MORE RAPIDLY THAN THE WELL-TO-DO

Next we visit the world's most famous tuberculosis sanatorium. Dr. Rollier of Leysin, Switzerland, in 1903, conceived the idea of

curing tuberculosis through sun baths. When I visited there in 1921 he had 800 patients. Now I am told he has 1,000 or more at a time. The patients are under treatment in 34 different sanatoria, some intended for the poorer classes, with charges totaling only one dollar per day, others for the well-to-do, at eight dollars per day. To Dr. Rollier's *great surprise,* the poorer classes, whose foods consisted largely of milk and vegetable products, were improving much more rapidly than were the well-to-do, with whom meat was the chief article of diet.

STUDENTS HEALTHY ON VEGETARIAN DIET

Thirty young men from a Danish Teachers' College started a boarding house where in accordance with my directions a very cheap vegetarian diet was served. The details of their menu were as follows:

TABLE 2

JONSTRUP TEACHERS' COLLEGE: BILL OF FARE

BREAKFAST, 7 A.M.—Bread, margarine and tea

SMALL LUNCH, 11 A.M.—Oat porridge and milk

DINNER, 1 P.M.

Barley-fruit soup	Kale soup	Stewed kale with fried potatoes
Barley gruel with butter and milk	Oats-fruit soup	Stewed vegetables, bread
Potatoes with onion sauce	Potato salad, bread	Potatoes with parsley-sauce
Buttermilk soup	Stewed cabbage, bread	Stewed macaroni and carrots, bread
Bread soup with milk	Apple porridge	
Fried cabbage, bread	Stewed carrots, bread	
Apple soup	Mashed potatoes with fried onions	
Chocolate soup	Prune porridge with milk	

SUPPER, 7 P.M.

Sandwiches with cheese, jam, pickled beets, potatoes, different salads

Contents: 71 g. protein, 92 g. fat, 489 g. carbohydrates = 3,152 calories.
Price a day: 27 cents (14c for products, 13c for expenses).

This is a purely vegetarian diet, yet we find here only common Danish dishes, which everybody knows and which every housewife in Denmark can make. It is an example of vegetarianism for the poor, rather than vegetarianism for the rich, and *pauper vegetarianism is as effective as well-to-do vegetarianism.* These students attract attention by their unusually healthy appearance. The school has about 90 students. It is now three years ago that 20 of these started on the "Hindhede plan" of living, but that number has now reached 70 and only 20 remain on a meat diet.

All are in the best of health and indigestion is unknown.

On Jan. 9, 1928, I lectured at the University of Michigan and lived for two days at the beautiful Michigan Union, the students' hotel. I found there ten young Danish men and women, and talked with some of them. They complained about the food, meat 2 to 3 times a day, that gave them indigestion. One of the men told me of going to a physician, who charged him two dollars and wrote out a prescription, but to no avail. I suppose this is but one example of many. It

seems a shame to treat young people thus. I have never heard of indigestion among the thousands in Denmark who live according to my principles.

THE INFLUENCE OF FOOD RATIONING ON THE DENMARK DEATH RATE

We come now to a consideration of the Danish rationing during 1917 and 1918. The following table is taken from my report concerning the economy of raising pigs:[1]

TABLE 3

ECONOMY OF PIG PRODUCTION

A pig of 185 pounds (Danish) has eaten:

EXPENSE	Protein kg.	Fat kg.	Carbohydrate kg.	Calories 1000
Beets, 500 kg.	6.5	1.0	47.5	230
Separated milk, 500 liters	15.0	0.5	25.0	169
Barley and bran, 260 kg.	31.2	6.8	178.6	915
In all	52.7	8.3	251.1	1314
INCOME				
The pig gives	8.0	23.0		246
Balance	—44.7	+14.7	—251.1	—1068
Loss of calories, %	—84.8	—80.7		—81.3

That is to say, at least 80 per cent of the food is lost, and that of the most valuable materials, such as proteins, vitamins and organic salts. It is evident that *when food is scarce, the production of pigs is madness*. That is something Germany did not understand in 1915-1918.

But the Danish Government and Parliament and the Danish farmers understood this reasoning. The following table shows the result of the rationing on the death rate in Copenhagen:

TABLE 4

AVERAGE YEARLY DEATHS PER 100,000. AGE 25-65 YEARS. MEN IN COPENHAGEN

	1890-99	1900-04	1905-09	1910-14	1915-16	1917	Oct., '17-Oct., '18
Epid. diseases	88	55	42	36	42	38	50
Pneumonia	79	57	75	75	91	61	47
Tuberculosis	417	325	302	250	267	299	222
Cancer	157	162	194	204	182	177	168
Alcoholisms	65	69	83	57	36	10	1
Suicides	98	106	90	84	72	47	32
Accidents	68	68	60	55	70	33	27
Diseases of the brain	126	116	119	118	117	110	62
Other dis. of the lungs	72	75	64	60	64	64	36
Diseases of the heart	134	130	148	139	155	133	120
Diseases of digestion	71	75	71	75	76	77	66
Diseases of the kidneys	60	70	74	68	65	69	44
Other causes	147	142	139	150	149	118	110
All causes	1582	1450	1461	1371	1386	1236	985
Epid. dis. + tuberc.	505	381	344	286	309	337	272
All other causes	1077	1069	1117	1085	1077	899	713
Ratio	100	99	103.7	100.8	100	83.4	66.2

For men a decrease of 34, for women of 17 per cent.

The figures in the last column of Table 4 are not for the entire calendar year of 1918. During the last quarter of that year came the terrible influenza epidemic that disturbed everything.

(1) Report from the Danish Rationing Committee of April, 1917.

DECREASE IN ALCOHOL A FACTOR IN LOWERED DEATH RATE

Just how much of the lowered death rate observed was due to the decreased alcohol consumption, and how much was due to the changed diet, it is difficult to say. In respect to the men, no doubt alcohol played a significant rôle, and for that reason the decrease in death rate is much greater for the men than for the women. We see that if the deaths due to infectious diseases and tuberculosis are subtracted from the total, the death rate for men has remained practically constant for 30 years prior to the rationing period, at which time we observe a sudden drop of 34 per cent.

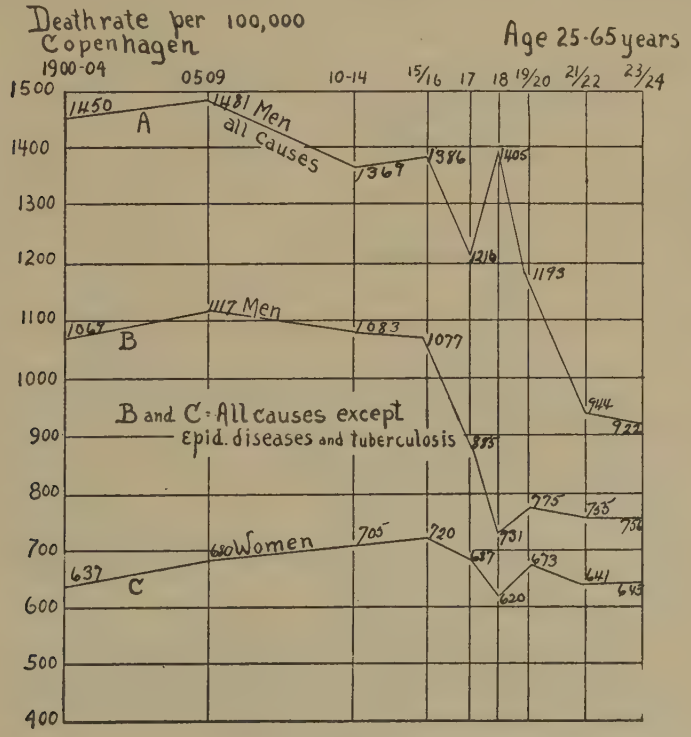

FIG. 1

The above figure shows curves indicating the changes in the death rate up to 1924. We observe for all causes a drop in 1917, but a rise again in 1918. This is because we here include all of the calendar year. The rise is due to the influenza epidemic during the last quarter of the year, yet, in spite of the influenza, the death rate in Denmark was no higher in 1918 than it was before the War. This is remarkable. The death rate in all our neighboring countries was in 1918 at least 25 per cent higher than before the War.

It seems, then, that through our rationing we saved as many deaths as the influenza caused. We notice that the death rate for women, due to causes other than infectious diseases, has been rising during the last 30 years. Why? Well, what are the causes of death that show an increase? The answer is shown in the following figure.

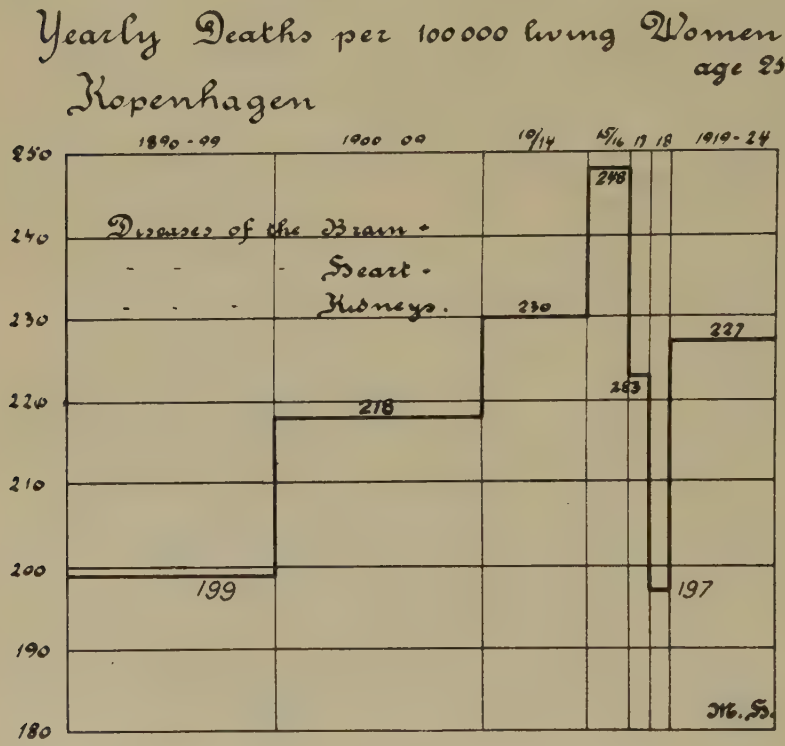

FIG. 2

BRAIN, HEART AND KIDNEY DISEASE DECREASED

It is the diseases of the brain, heart and kidneys in particular that show an increase. We note an abrupt drop during the rationing period, but later a rise again.

These diseases may aptly be called diseases of the well-to-do, for statistics from Bremen, Germany, show that well-to-do people have the highest death rate from such causes, while poor people die particularly from respiratory diseases.

TABLE 5

DEATHS PER 10,000 LIVING ABOVE 60 YEARS. BREMEN 1901-10

	Brain	Diseases of Heart	Kidneys	Tuberculosis	Pneumonia
Well-to-do people	68	132	18	16	61
Poor people	45	86	3	31	116

DEATH RATES IN MEAT-EATING COUNTRIES

The death rates in Greenland and in Denmark are compared in Table 6. It is evident that for Eskimos the death rate, at the prime of life, is for men 4 times, for women 3 times higher than for the Danes. The Eskimos cannot therefore be used, or *misused,* as proof of the harmlessness of a meat diet. They may appear strong and healthy, but the internal organs are probably ruined at an early age.

TABLE 6

DEATH RATES IN DENMARK, GREENLAND AND ICELAND. DEATHS PER 10,000 LIVING—1880-89

	MEN				WOMEN			
	35-40	40-45	45-50	50-55	35-40	40-45	45-50	50-55
Denmark	78	98	126	168	84	93	102	122
Greenland	249	388	521	634	228	292	271	479

The death rate for men is 4, for women 3 times as great in Greenland as in Denmark.

DEATHS PER 10,000 LIVING

	25-30	35-40	45-50	55-60	All ages
Denmark, 1850-60	73	96	164	289	
Iceland, 1840-70	145	174	243	378	
Denmark, 1920					129
Iceland, 1920					144

In the last half of Table 6 are compared the death rates of Denmark and Iceland. Seventy years ago when the Icelanders were living largely on animal foods, the death rate was 50 to 100 per cent higher than in Denmark, but since then importation of cereals has increased and the difference in the death rate has dropped to 11 per cent.

English statistics show the different death rates for 98 different trades and professions. For the following table, I have selected, for seven typical occupations, the death rates due to six nutritional diseases, to tuberculosis, and the total death rate for all causes.

TABLE 7

DEATHS IN AGES 25-65 PER 100,000 LIVING—ENGLAND, 1910-12

	Farm worker	Farmer	Priest	Unskilled workman	Doctor	Butcher	Innkeeper
Alcoholism	1	4	1	8	7	14	55
Apoplexy	22	32	42	60	52	63	96
Dis. of Digestion	31	41	59	55	85	54	80
Cirrh. of liver	6	15	4	20	31	48	165
Nephritis (Bright's disease)	25	37	42	65	66	74	134
Diabetes	6	17	19	11	18	31	39
Six causes	91	146	167	219	259	284	569
Ratio	100	160	183	240	284	310	625
Tuberculosis	114	93	73	321	104	191	293
All causes	662	697	624	1579	976	1246	1782
Ratio	100	105	94	238	147	188	269

WHERE FARM LABORERS HAVE A LOWER DEATH RATE THAN PHYSICIANS

First is given causes of death most closely related to the nutrition. We notice that the very poorest of the classes shown, the farm laborers, working for 2-5 shillings per day, and whose diet consists chiefly of cereals, potatoes, oleomargarine, milk and a small amount of pork, have by far the lowest death rate due to nutritional diseases. On the other hand the physicians and the butchers, who no doubt eat considerable meat, have about three times the death rate due to these causes. It is not easily overlooked that, out of the 98 occupations listed, there is not one that shows so high a death rate due to diseases of digestion as is shown for the medical profession.

That indicates that mistaken knowledge is worse than no knowledge at all!

The following table is a short summary of several typical forms of diet.

TABLE 8

CONSUMPTION IN GRAMS PER MALE UNIT

	Meat, eggs, cheese	Fats	Milk	Whole bread	White bread, flour, sugar	Fruits, vegetables	Potatoes
1. Farmers, U. S.....1923	332	67	768	7	526	749	283
DENMARK							
2. Farmer workmen ...1880	63	42	300	734	63	...	458
3. Farmers 1927	190	83	832	341	391	125	357*
4. Agrc. College 1920	136	78	669	239	446	103	900
5. Teachers' College...1926	19	81	303	323	396	203	240
6. Hindhede family....1906	38	89	553	157	396	587	
ENGLAND							
7. Farmer workmen....1911	98	39	221	...	591	68	293
8. Well-to-do	331	55	524	...	496	305	250
9. Irish cottager.....1926	...	53	922	...	834	...	1376
GERMANY							
10. Workmen, Hamburg.1921	71	50	294	328	199	178	750
11. Eden colony 1921	11	41	252	501		787	612
TUBERCUL. SANATORIA							
12. Denmark, Vejle.....1905	504	150	1403	375		75	136
" " 1920	493	107	864	464		359	581
13. Switzerl., Leysin....1921	58	23	827	...	310	364	442
14. Danish rationing....1917	87	45	500	446	121	125	500

*Abnormally low because the research was made in May-June, when the potatoes were scarce.

In this table please note that (1) is the average for 1,331 American farmers, and is taken from an official report of the United States Department of Agriculture; (2) indicates how Danish farm laborers fared about 50 years ago (my father while not a farm laborer was a farmer and the food served at our home was not much different from that here indicated); (3) shows how the Danish farmer now lives; (4) illustrates the diet at a Danish Agricultural College where an effort is being made to live according to Hindhede's principles; (5) is the already mentioned teachers' college; (7-9) are characteristic forms of diet for different classes in England. The English well-to-do live much as does the American farmer; (10-11) are typical

German diets, the latter (11) being the diet at the vegetarian colony, Eden, which was previously mentioned; (12) shows normal Danish Sanatorium diets for the tuberculous; while (13) is the diet which Dr. Rollier of Switzerland found to be best. Finally, (14) represents the Danish ration which had such a good effect in 1917-1918.

You will recall the high death rate due to nutritional diseases observed for the well-to-do in England (physicians for example).

As your American diet seems to be like that of the well-to-do English, I suppose it is permissible to conclude that your diet will likewise spoil your stomach, your liver, your kidneys, and will result in early degeneration of the blood vessels followed by apoplexy. As I feared you might not admit this, I turned to your statistics. Table 9 shows the results for six of your older states. Here again we compare the death rate for certain selected diseases with the total death rate for all causes.

TABLE 9

DEATHS IN AGES 25-65 PER 100,000 LIVING—1924

	Massachusetts	New York	Connecticut	New Jersey	Michigan	Indiana	Average	Denmark	Denm. + or — %
In cities	81	77	76	65	55	45	..	42	....
Alcoholism	12	10	8	7	8	3	8	3	....
Apoplexy	73	68	72	74	61	72	69	34	—51
Dis. of digestion	57	61	53	62	61	64	61	37	—39
Cirrh. of liver	7	12	8	14	8	10	11	2	....
Nephritis	70	95	72	99	51	77	82	24	—71
Diabetes	20	27	20	23	16	16	22	13	—41
Six causes	239	273	233	279	205	242	253	113	—55
Ratio	211	242	206	246	181	214	224	100	....
Tuberculosis	109	122	112	118	93	101	113	108	— 5
Cancer	135	139	127	122	103	97	126	142	+11
All causes	949	1098	912	1039	894	900	1006	715	—29
Ratio	133	154	128	145	125	126	141	100	....

The death rate for the six causes mentioned first is on the average more than twice as high here as it is for Denmark, and for nephritis (Bright's disease) alone about 3½ times as high.

Now let us make the same comparison with figures for some of the states in the Middle West. In Table 10 are given the statistics covering Ohio, Missouri, Kentucky and Kansas. These were selected because it was there the Department of Agriculture carried on its investigations. A comparison here leads to the same results. Again the death rate due to the 6 first causes is twice as high as in Denmark. As you kill more people during their prime of life, there are naturally more old people in Denmark, as is indicated in the table.

TABLE 10

DEATHS IN AGES 25-65 PER 100,000 LIVING—1924

	Ohio	Missouri	Kentucky	Kansas	Average	Denmark	Denm. + or — %	Six older states
In cities %	58	42	21	26	..	42	....	..
Alcoholism	4	5	3	2	4	3	....	8
Apoplexy	66	58	60	58	62	34	—45	69
Dis. of digestion	58	60	53	65	59	37	—37	61
Cirrh. of liver	9	11	8	6	9	2	....	11
Nephritis	60	90	74	56	69	24	—65	82
Diabetes	17	17	11	12	15	13	....	22
Six causes	214	241	209	199	218	113	—49.2	253
Ratio	189	213	185	176	193	100	....	224
Tuberculosis	103	117	157	60	110	109	— 2	113
Cancer	102	108	78	89	98	142	+31	126
All causes	880	962	902	713	874	715	—18	1006
Ratio	123	134	126	100	122	100	....	141

NUMBER OF PEOPLE OVER 65 YEARS PER 10,000

	475	557	478	607	528	684	....	514
Ratio	69	81	70	89	77	100	....	75
Colored %	3.6	5.5	9.1	3.3	5.4	...	....	2.2

Inasmuch as the ratio between city and country population in Missouri is identical with that in Denmark, I have chosen that state for a more detailed comparison of death rates for different ages.

First let us note in some detail the differences in diet. Table 11 is a comparison of average farm diets in Denmark and in Missouri:

TABLE 11

FOOD CONSUMPTION BY FARMERS. GRAMS PER DAY PER MAN UNIT

	Denmark	Missouri
A		
Meat, eggs, cheese	190	381
Whole milk	376	970
Fruits, vegetables	482	1293
Butter	7	39
Totals	1055	2683
B		
Whole grain bread	341	7
Skim milk	456	0
Oleomargarine	62	0
Totals	859	7

According to prevalent American opinion we should expect this large amount of meat, milk, fruits, vegetables and butter to give, especially to the children, a higher resistance against disease than the Danish children can have with their poor skim milk and vegetable margarine diet. But what do we learn from statistics about that? The following figures give the answer:

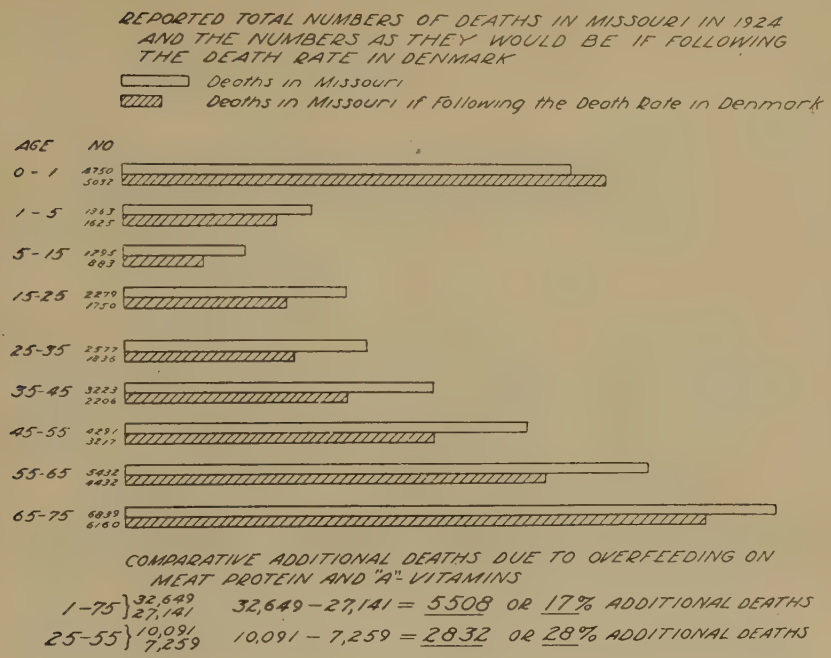
REPORTED TOTAL NUMBERS OF DEATHS IN MISSOURI IN 1924 AND THE NUMBERS AS THEY WOULD BE IF FOLLOWING THE DEATH RATE IN DENMARK
Deaths in Missouri
Deaths in Missouri if Following the Death Rate in Denmark
AGE NO
0 - 1 4750 5032
1 - 5 1363 1625
5 - 15 1295 883
15-25 2279 1750
25-35 2577 1836
35-45 3223 2206
45-55 4291 3217
55-65 5432 4432
65-75 6839 6160
COMPARATIVE ADDITIONAL DEATHS DUE TO OVERFEEDING ON MEAT PROTEIN AND "A"- VITAMINS
1-75 } 32,649 27,141 32,649 - 27,141 = 5508 OR 17% ADDITIONAL DEATHS
25-55 } 10,091 7,259 10,091 - 7,259 = 2832 OR 28% ADDITIONAL DEATHS

FIG. 3

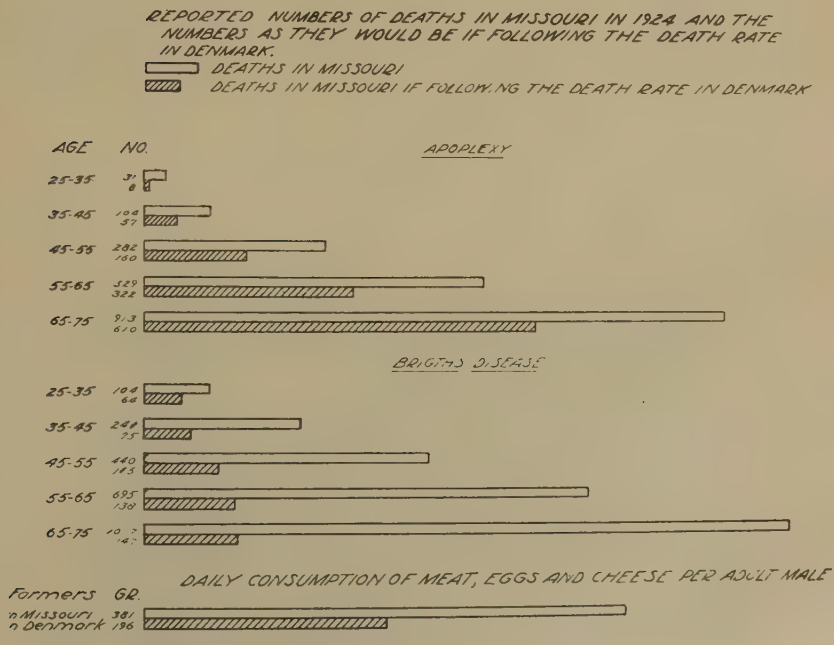
REPORTED NUMBERS OF DEATHS IN MISSOURI IN 1924 AND THE NUMBERS AS THEY WOULD BE IF FOLLOWING THE DEATH RATE IN DENMARK.
DEATHS IN MISSOURI
DEATHS IN MISSOURI IF FOLLOWING THE DEATH RATE IN DENMARK
AGE NO.
APOPLEXY
25-35 31 8
35-45 104 57
45-55 282 160
55-65 529 322
65-75 913 610
BRIGTHS DISEASE
25-35 104 64
35-45 244 75
45-55 440 145
55-65 695 138
65-75 10 7 147
DAILY CONSUMPTION OF MEAT, EGGS AND CHEESE PER ADULT MALE
Farmers GR.
in Missouri 381
in Denmark 196

FIG. 4

Curiously enough these numbers do not indicate a superior resistance in American children. On the contrary it seems to be less. In Figure 4 the results are given for two causes in which nutrition plays a major rôle.

HIGH MEAT DIET RUINS KIDNEYS

One notices the terrible death toll in America due to Bright's disease. I can no longer doubt that the high meat diet ruins the kidneys, especially in view of Dr. Newburgh's experiments, proving as they

TABLE 12

REGISTERED DEATHS IN 1924 DUE TO APOPLEXY, BRIGHTS DISEASE, DIABETES

REGISTERED POPULATION	DENMARK 3,400,000	U.S.A. 103,108,000
DEATHS-		
APOPLEXY	1,991	87,064
BRIGHTS DISEASE	693	99,230
DIABETES	424	17,385

IF THE DANISH RATE WERE MAINTAINED IN THE U.S.A. WE SHOULD HAVE ONLY—

DEATHS-	
APOPLEXY	49,830
BRIGHTS DISEASE	20,790
DIABETES	12,720

SUBMITTED BY-
L. H. NEWBURGH – Prof. of Clinical Investigation
University of Michigan
J. SUNDWALL – Prof. and Director of Public Health
University of Michigan

do that we may, with mathematical certainty, produce Bright's disease even in rats by placing them on a high meat diet.

I feared that you might doubt my statistics, and might consider me merely another "crank," so I placed my figures before Dr. Sundwall, Professor of Hygiene of the University of Michigan, and asked him to check their correctness. Dr. Sundwall and Dr. Newburgh recalculated the data, and authorized the publication of their results as summarized in the above table.

It was at once apparent that my statements had been conservative.

In the following table I have compared the Dane and the American in the same manner as the different occupations in England were previously compared. You see again that my suppositions were warranted. The Danes believing in a rather poor farmer diet die as English farmers. But you believe in doctors and die as doctors!

TABLE 13

DEATHS BETWEEN AGES OF 25-65 PER 100,000 LIVING—1924

	Denmark	United States	England* Farmers	England* Doctors
Alcoholism	3	8	4	7
Apoplexy	33	69	32	52
Diseases of digestion	37	61	41	85
Cirrhosis of liver	2	11	15	31
Nephritis	24	82	37	66
Diabetes	13	22	17	18
Six causes	112	253	146	259
Ratio	123	278	160	284
Tuberculosis	108	113	93	104
All causes	715	1006	697	976
Ratio	108	152	105	147

* (See Table 7, page 399.)

HOW AMERICA MAY SAVE 200,000 LIVES ANNUALLY

Allow me now to present a picture that you must all be familiar with.

U.S. Dept. of Agriculture Poster

Comments I believe are unnecessary. It is what we in Europe call an "American," just an innocent slip in proper proportions—*10 lbs. of meat to 7 potatoes!* But allow me to make a small correction, and change it to—*70 potatoes and 1 lb. of meat.* If you will do that, I can promise you that you will save each year about 200,000 lives between the ages of 25 and 65 years—that is 200,000 men and women in the prime of life are now dying needlessly because of a faulty diet.

Permit me to close with the following rather harsh criticism, which I beg of you to excuse as coming from me who may have only this one chance to impress you with convictions gained through many years of careful observation.

Many of your modern textbooks need to be revised. It is not merely the mistake about "good proteins" that requires correction. When I observe that your children, besides a lot of fruit, butter and a quart of milk, are forced to swallow cod liver oil, I am moved to say, "poor children." I am reminded of the Danish children with almost no fruit, hardly any butter, only about ½ pint of milk, and no cod liver oil, and yet having a lower death rate than your children. They get sufficient vitamins from whole-wheat or whole-rye bread, potatoes, cabbage and kale, and such a diet is by far the cheapest.

People everywhere are crying for pleasure, pleasure and more pleasure. They do not realize that the greatest pleasure within their reach is to be so permeated with health and the happy feeling of well-being that there can be not the slightest temptation to use poisonous stimulants such as alcohol and tobacco.

But what are the signs of such a perfect state of health, you ask? I will tell you.

When you awake in the morning it should be with an irresistible inclination to stretch in exuberant vigor. This feeling of exuberance and well-being should follow you through the day, and you should each moment be tempted to shout, "How splendid it is to be alive!"

But the conditions upon which depends the attainment of this perfect feeling of health and vigor are many, among them are fresh air, sunshine, exercise, no poisonous stimulants. Of one thing I am most certain, you will never reach it through the use of a diet that is leading you towards indigestion and nephritis.

THE HARMFUL EFFECTS OF DIETS RICH IN PROTEIN

Dr. Louis H. Newburgh, Professor of Clinical Investigation,
University of Michigan

Doctor Hindhede, of Denmark, has told you of his experiments with men, which show how much improvement in health can be obtained by restricting the protein of the diet. My report will show you much harm

Fig. 1

can be done to the kidneys of animals by putting the protein of the diet too high.

In order to save time, I will show you merely a few slides starting with the kidney of a rabbit (Fig. 1) that received a diet containing twice the amount of protein that would ordinarily be fed to rabbits

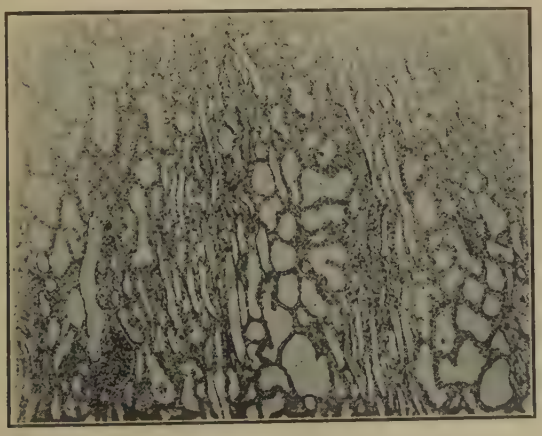

Fig. 2

in the laboratory. The most striking feature of this slide is the large number of casts. In addition, you will notice that the tubules are dilated. This increase in the tubular space is due to the disappearance of the lining membrane. Instead of the row of plump cells lining these tubules, there is, in many of them, almost nothing left. That is the effect on the rabbit's kidney of eight months of a diet moderately high in protein.

BEEF PROTEIN

The second slide (Fig. 2) is from the kidney of a rabbit whose diet contained a considerable amount of beef protein. The diet consisted of a mixture of flour, bran and powdered beef. Baking powder and salt were stirred in and the mass, mixed with sufficient water, was kneaded into a dough and baked. Nothing we ever fed rabbits was so pleasing to them. As a result they grew to be abnormally large and gave the appearance of great vigor. Visitors to the laboratory were

Number of Casts in 24 Hrs.

Averages from Casein and Beef Protein

Protein	240 Days	480 Days
12 - 18 %	2	4
25 %	0	83
32 %	44	393
39 %	53	652
75 %	2148	4816

TABLE I

impressed by the fine appearance of these animals. You see that a year of this diet has produced a really serious injury to the kidney tubules. The large spaces are caused by the disappearance of the active cells of the tubules. That is, the cells that perform the excretory function of the kidney have largely disappeared.

After we had finished the work with the rabbits, our experiments were criticized on two scores: First, that the rabbit is herbivorous and is therefore more easily injured by excess of protein than man. This objection assumes that man is not herbivorous in nature, but I know of no evidence that such is the case. The other criticism was that the rabbit is an animal whose organs are liable to a variety of minor injuries spontaneously. It is accordingly hard to determine what was caused by experiment and what by intercurrent events.

We accordingly turned to another type of animal, the white rat. He is omnivorous, and is very resistant to disease.

The first table (Table 1) shows you the result of diets high in protein measured by the number of casts in 24 hours in the urine. The table is made up from all of the animals whose diet either contained an excess of casein or an excess of beef protein. All of the animals are bunched together.

The casts were counted after the animals had been on the diet 240 days, 8 months, and again in 480 days. The per cent of protein in the diet as measured by its dry weight is indicated. Diets containing 12 to 18 per cent of protein were used as the controls. You will notice that rats on that amount of protein showed only a very few casts. If one examines any large series of any type of animals, as far as I know, one occasionally finds a cast in the urine, so that the presence of 2 or 4 or 5 casts per 24 hours per animal is normal. Nobody considers that an abnormality. One must have many more. This series of control rats showed in the urine just about what we would have expected.

Number of Casts Caused by Different Kinds of Protein

	240 Days	480 Days
Casein 75%	1100	2400
Beef 75%	3200	16000
Liver 75%	15000	Dead

TABLE II

THE TIME FACTOR IS IMPORTANT

When the diet becomes 25 per cent protein, there is in the first period still no evidence of injury. However, after more than a year, you see there is an abnormally large number of casts in the urine. If one goes through this whole series, one sees very easily that the time factor, as well as the amount of protein, is important.

Very little injury is caused in eight months by diets containing as much as 39 per cent of protein, but if one continues another eight months there is evidence of very marked injury. However, if one makes the protein in the diet sufficiently high, 75 per cent, the injury in eight months becomes very severe so that one gets very striking evidence here of the double effect, the effects of concentration and the effect of time. Thus far, we have disregarded the type of protein.

TYPE OF PROTEIN IMPORTANT

This next slide (Table 2) deals with the question of whether different kinds of protein fed in the same amount produce different degrees of injury. These animals all received the same amount of protein, three-fourths of the diet. The first group received casein, the second dried powdered beef, and the third group dried powdered beef liver.

The difference in these three proteins is very striking. In eight months casein produces a degree of injury, represented by 1100 casts, beef roughly three times as much, and the liver protein very much more. Of course, these figures are not absolute. They simply are indications of degree. Animals that are continued on these diets show

FIG. 3

further injury with again the same striking difference—the least injury from casein, much more injury from beef protein, whereas all of the animals on the third type, the liver protein, were dead before the first year was out. So the type of protein is important.

I am now going to show you a few slides to give you some idea of how these rat kidneys look.

Figure 3 is the kidney from a rat that received a diet containing about one-third of its weight in protein. You see again the same

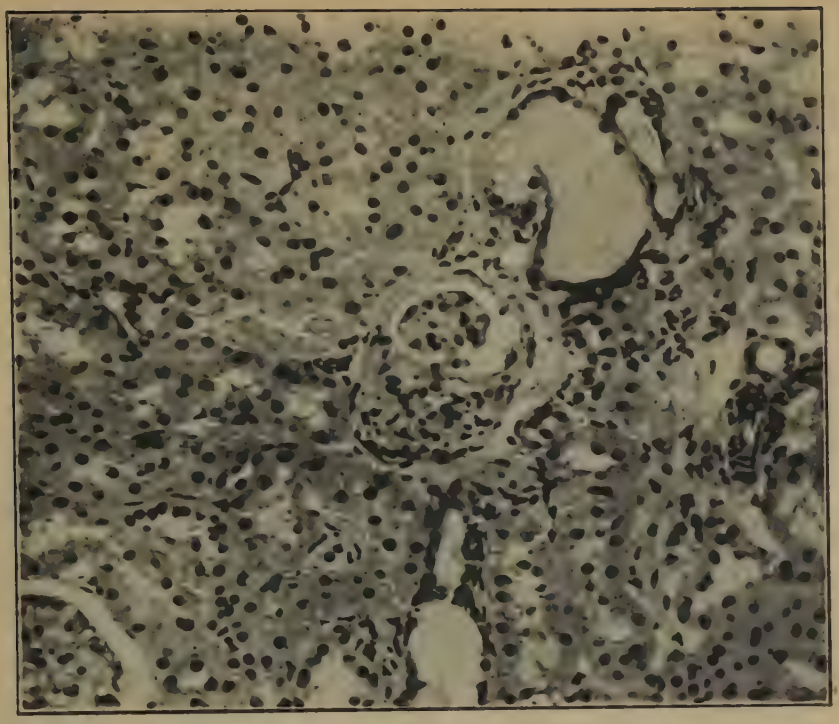

Fig. 4

Fig. 5

general appearance as you saw in the rabbits, the injury of the tubules everywhere, the atrophy of the tubular membrane, but no evidence of injury of the glomerulus.

Figure 4 is the kidney of a rat on the same type of diet but for some months longer. This, of course, is a higher magnification. The special feature of this section is the glomerulus showing the huge mass of connective tissue which is abolishing it. Hence, a diet containing one-third its weight in beef protein eaten by a rat for about a year and a half shows very marked injury of the tubules and the glomeruli.

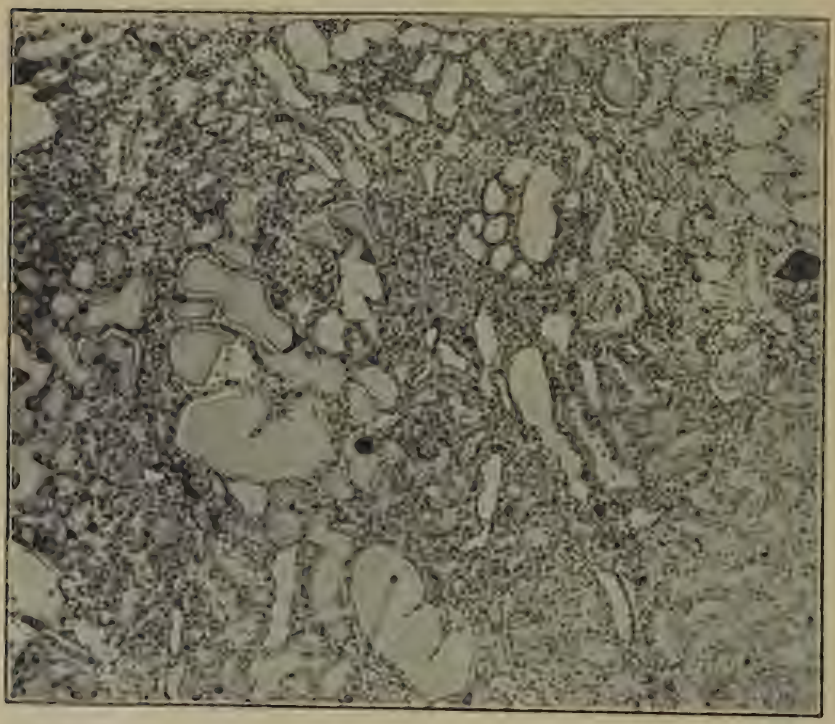

Fig. 6

OBTAINING A CHRONIC DISEASE

The next slide (Figure 5) shows the effect of 75 per cent of beef protein for a somewhat shorter period. In the center of the section is a collection of connective tissue cells. Scar tissue is beginning to grow in the kidney. In other words we are obtaining a chronic disease. This condition is beginning to suggest chronic nephritis. In the center of the field you see a very large number of nuclei. The connective tissue is much more abundant than it was in the previous slide. In addition you see the thickening of the membrane around the glomeruli.

This slide (Figure 6) represents the kidney of a rat that was being fed the diet containing liver protein. Here the injury is very much more marked. You see the practical destruction of the tubules down through the center of the section with contraction. The edge of the

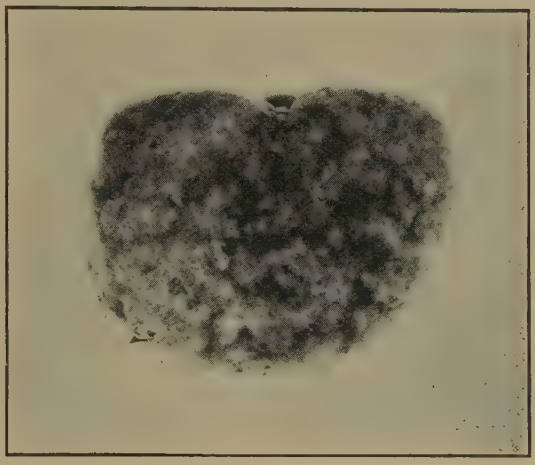

FIG. 7

kidney is pulled in by the connective tissue, which is contracting as every scar does and which has abolished the kidney as such in its upper portion. This animal was on the diet only nine months and he was evidently within only a few hours of death when we killed him, so that this diet kills the animals in less than a year with chronic nephritis.

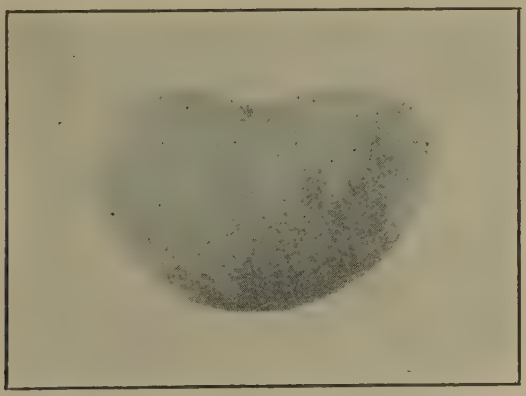

FIG. 8

THE EFFECT OF EATING LIVER

Next (Figure 7) is the kidney from a rat eating the liver diet. It should be compared with the photograph of a normal rat kidney (Fig-

ure 8). I want you to notice the difference between these two kidneys. The second is perfectly smooth, as it should be. The former is rough and granular, filled with scars, with masses of connective tissue, so that

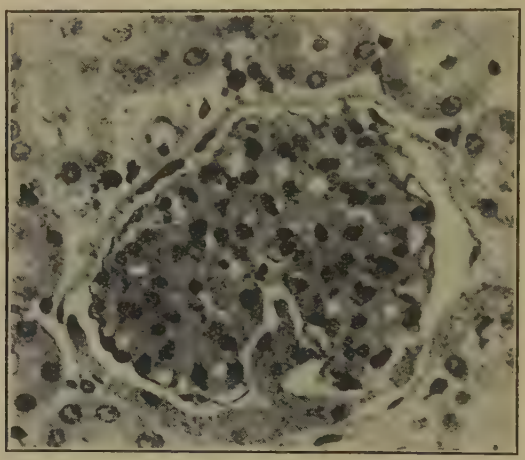

FIG. 9

we have here the standard gross appearance of a kidney that the pathologist labels "chronic nephritis."

The great question, of course, is, "How does protein produce such an effect?" I cannot take the time to go into a most interesting discus-

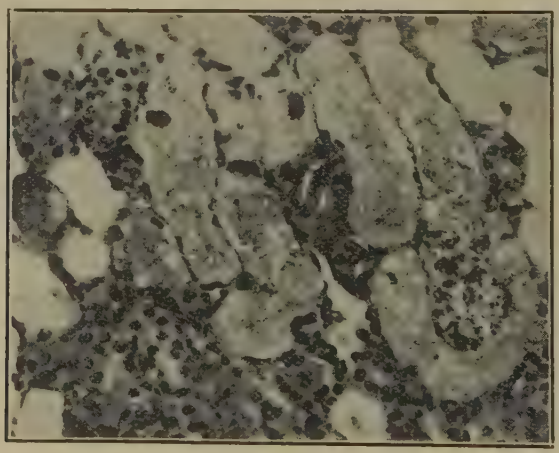

FIG. 10

sion. I want merely to mention a few things about some of our own experiments.

THE HARMFUL PROTEIN CONSTITUENTS

All protein is digested into amino-acids before absorption. The amount of amino-acid absorbed is, of course, proportional to the amount of protein injested. We injected a number of amino-acids into the

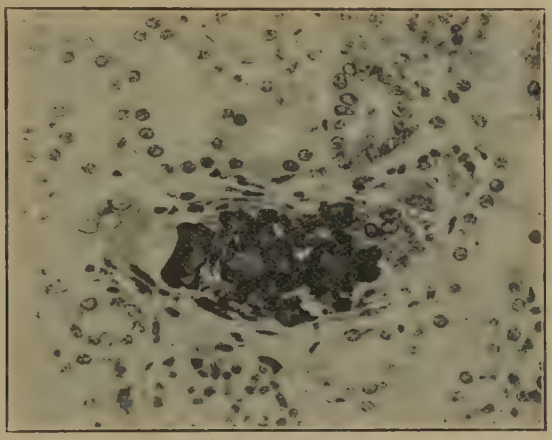

FIG. 11

circulation of dogs, carnivorous animals, to see what effect these substances would have on the kidneys, and here is a list of these amino-acids, showing that some are harmless and some are harmful:

Cystine in the Diet	First appearance of Casts.
20.00	Hours
10.00	3 Days
5.00	7 Days
2.50	15 Days
1.10	2 Months
0.50	4 Months
0.25	None in 12 Months

TABLE 3

Figure 9 is the glomerulus of a dog's kidney injured by the amino-acid tyrosin. You see a mass in the glomerular space which is foreign to the kidney.

Figure 10 shows the destruction of the renal tubules by another amino-acid, tryptophan.

Figure 11 is a highly magnified tubule containing a mass of dead material produced by the amino-acid cystin.

We then turned to the feeding of some of these amino-acids that we had found to be poisonous. Here is our experience with the feeding of cystin to rats. Cystin was added to otherwise normal diets. If we

Fig. 12

start at the bottom of the chart (Table 3), we find the addition of a quarter of one per cent gave no evidence of injury in one year. As we go up the chart, we find when twenty per cent of the diet is cystin the urine becomes abnormal within the first day of the diet, so that there is a regular increase in evidence of injury with an increase in the amount of cystin in the diet.

This (Figure 12) is a kidney from a rat that received a diet containing five per cent of cystin for several weeks. The pale band is the region of injury.

WHERE WE STAND NOW IN OUR KNOWLEDGE OF NUTRITION

Dr. E. V. McCollum, Professor of Biochemistry, School of Hygiene and Public Health, Johns Hopkins University

One of the most spectacular fields of progress during the last three decades is that relating to our knowledge of foods and of the physiological needs of the body. The activity of investigators on the various aspects of the nutrition problem is well illustrated by the extent of two recently compiled bibliographies. In January, 1925, Dr. Nina Simmonds and I completed the manuscript of the third edition of our book, in which we included 1,870 references to the literature. Two years later Burg, covering much the same field, included in his book a bibliography of over 3,400 titles.

TODAY'S "COMPLETE" DIETARY

It is interesting to contrast the method of visualizing a complete dietary now with that of 30 years ago. Then it seemed satisfactory to many close students of the subject to accept the idea that a mixture containing what was regarded as suitable proportions of proteins, digestible carbohydrates, fats, and almost any kind of an inorganic mixture provided by a dietary selected from natural foods, would be satisfactory for the promotion of growth and the maintenance of health. Today nutrition investigators visualize the diet as consisting of approximately 35 chemical substances. Of these, 19 are digestion products of proteins, 9 at least are inorganic or mineral elements, one is sugar—glucose or some carbohydrates that can be converted into glucose by digestion—and 6 or more belong to the class of nutrients called vitamins. It is recognized that there are great differences in the constitution of proteins from different sources, and that the biological value of the proteins varies correspondingly. It is also appreciated that proteins from two different sources that are of low biological value may be so constituted as greatly to enhance each other's value when combined. One of the most interesting developments of the science has been that relating to the proportions, among the different inorganic elements contained in the food supply, that best promote physiological well-being.

Methods have been worked out by means of which laboratory animals—the rat in particular—can be used in systematic studies for the biological assay of any food or combination of foods, and we now possess extensive knowledge concerning the food value of most of our

more important natural foods. Similar studies have yielded detailed knowledge concerning the effect of various manufacturing processes, canning, preserving, cooking, etc., on the nutritive qualities of foods. Examples of such knowledge are the inferiority of that portion of the wheat kernel that principally finds its way into human dietaries as contrasted with the entire wheat kernel, also the destruction of vitamin C, with consequent loss of antiscorbutic properties, from heating foods either in ordinary cooking or in canning.

DANGERS FROM VITAMIN DEFICIENCY

An enormous amount of labor has been put upon a study of the specific types of biological change that result from specific dietary deficiencies. It is impossible here more than to mention this phase of investigations. Deficiency of vitamin A has been correlated especially with injury to the epithelial type of cell, this injury extending even to the germinal epithelium. What has passed under the name of vitamin B is now generally believed to consist of at least two principles, each indispensable for life or health. The proposed nomenclature in this group is in a state of confusion, but the prevailing views indicate that the deficiency of one factor injures especially the motor nerve cells, whereas the second factor is in some way associated with the development of lesions characteristic of pellagra.

Vitamin C, the most unstable of the group to high temperatures and oxidation, is the principle a deficiency of which causes scurvy. The injury from a deficiency of this principle is apparently confined in great measure to the endothelial type of cell. Most interesting are the researches relative to vitamin D, the active principle in fish liver oils upon which depends their therapeutic value in the prevention and treatment of rickets. This substance has been shown to belong in the sterol group, and is closely related to cholesterol, long known as a constituent of every animal cell. Closely similar substances are found in all plant structures. We appear to have more definite knowledge of the chemical nature of this principle than of any other of the vitamins. It was first demonstrated by Steenbock that by irradiating with ultra-violet light the non-saponifiable fraction of fats and oils, antirachitic potency was developed. Later developments showed that ordinary cholesterol could be activated, but eventually it developed that cholesterol in a highly purified form could not be made by ultra-violet light to acquire antirachitic potency. Windaus, in collaboration with Hess, has brought forward the view that a peculiar sterol characteristic of fungi, and especially abundant in ergot and in yeast, namely, ergosterol, is the pro-vitamin. This view has been confirmed by several independent

workers, and there is no reason to doubt that even astonishingly small doses, such as .02 mg. daily, for a rat is effective in causing incipient healing of the rachitic lesion. The most significant contribution to this subject has recently appeared from the laboratory of Jendrassik. He has shown, in accord with the results of various investigators, that whereas cholesterol of high purity cannot be activated by ultra-violet light, the simple expedient of moistening it and evaporating the water results in restoring its property of responding to ultra-violet irradiation and the development of antirachitic potency. So far as can be seen at present, the vitamin effect in this case will probably not depend upon one specific substance but rather upon certain niceties of structure that may be possessed by several closely related compounds. The prevailing view is that when the rays of ultra-violet light in ordinary sunlight or from some other source fall upon the skin, some substance belonging to the sterol group is so changed as to acquire the principles attributed to vitamin D, and that the superficial capillaries mobilize and transport this active material throughout the tissues.

Nothing is yet known of the chemical properties of vitamin E further than that it occurs in fats, and that its distribution is very unlike that of vitamins A and D, the other two fat-soluble vitamins. It is not definitely known whether or not vitamin E belongs to the sterol group. Studies of Japanese investigators, notably those of Takahashi, indicate that vitamin A is also closely similar to the more abundant sterols contained in animal and plant tissues.

THE BODY'S MINERAL REQUIREMENTS

Of special interest and significance from the standpoint of human well-being are the results of studies of the inorganic or mineral requirements of the body for normal metabolism. The relation between a supply of iodine, of which extraordinarily small amounts are necessary, and the prevalence of simple goitre, is a notable illustration in this connection. All animal studies have tended to emphasize the importance of proper content and relationship among the inorganic elements of the food supply. Rickets is primarily a disease in which the metabolism of phosphorus and calcium is concerned.

THE RELATION OF DIET TO DENTAL DISEASE

Elaborate experiments of the last few years with laboratory animals have shown beyond question that inadequate dietary regimens, yet sufficiently good to induce nearly or quite normal growth, may yet induce profound injury to the structure of the teeth. The studies of Grieves in my laboratory, and those of The Forsyth Dental Clinic, are outstanding in this field. They suggest the importance of a most careful

inquiry into the relation between the diet and dental diseases in man. Some months ago I had the pleasure of visiting with Dr. Russell Bunting of Ann Arbor an orphanage in Toledo where for several years he has had the supervision of the food supply. Dr. Bunting planned the menus with a view to controlling the prevalence of B. acidophilus in the mouth. He has given strong reasons for believing that wherever this organism constitutes the prevailing flora in the mouth, the individual is more susceptible to dental caries. He has worked out a technique that has apparently yielded results in the control of caries of human mouths, and the most significant thing about his studies is the freedom of many of the children in the orphanage from caries, apparently because of the character of the food supply. Whereas the average child probably consumes not far from 8 pounds of sugar per month, these children get only a few ounces. He has also provided a dietary with favorable relationships of calcium and phosphorus, the calcium being provided in approximately a quart of milk per day per child. The plan of the menus involves the regular eating at the end of each meal of foods such as salads, apples, etc., which have a detergent action upon the teeth. I know of no study that so clearly points out, as does this one of Dr. Bunting, the possibility of safeguarding children against dental disease through a properly planned dietary.

Interest in this subject has grown greatly among the members of the dental profession in recent years. The Research Committee of the American Dental Association is now providing funds, which are supplemented by the United States Bureau of Animal Industry, for the conduct of an elaborate study on swine. The purpose of this study is to reveal to what extent defects of structure and susceptibility to dental disease can be controlled by the character of the food supply. Swine were used for this study because the gestation period is sufficiently long—112 to 115 days—to make possible a nutritional influence over a considerable time on the prenatal nutrition of the young. Also young swine lose their desiduous teeth, which are replaced by the permanent dentition, by the tenth to sixteenth month. This species is, therefore, especially desirable for such a study.

HOW THE STEEL-FACED PLOW HAS INFLUENCED DIETARY HABITS

About 10 years ago I began to emphasize the fact that many Americans subsisted upon a diet too largely derived from white bread, meats of the muscle variety, sugar and potatoes. I pointed out that changes of a significant nature had been steadily in progress over many years. It is not generally appreciated even today that our generation eats more cereal foods than our ancestors. The modern steel-faced plow, which was invented in America between 1840 and 1850, and was

effective in destroying even the toughest grass and sod, enabled farmers within the course of 4 or 5 decades to convert vast areas that formerly were fit only for pasturage into grain fields. The entire Mississippi Valley, Canada, Austria, Argentina, Southern Russia, and South Africa, have been developed largely as a result of the invention of the plow, which could cut with a minimum application of power a ribbon of soil 12 to 16 inches wide, and turn it over with precision so as to expose the roots of the grass to the drying action of the air and to the destructive action of sunlight. One man with modern farming implements can now produce as much grain as a score of laborers with primitive implements.

Since 1879, when the roller mill process for making flour was invented, we have seen steady progress in the extent to which highly refined wheat flour has replaced the whole grain bread of earlier times. Furthermore, the consumption of sugar per capita in the United States has increased to 100 pounds in a century and now stands about 115 to 116 pounds.

HOW IMPROVED TRANSPORTATION HAS INFLUENCED FOOD HABITS

The concentration of large portions of the population in cities has revolutionized the marketing situation. Whereas formerly gardens and fields served as the source of the local food supply, today foods from afar are universally used. The fact that food production is in the main relatively far removed in the United States from centers of population has resulted to a significant extent in the development of processes of several kinds for preserving foods or for decreasing their tendency to deterioration while in transit or in storage. These are the main causes why Americans came to rely so exclusively upon refined wheat flour, refined corn meal, polished rice and sugar. The meat consumption has been maintained because of our capacity to produce and likewise because of its great palatability.

DEFECTS OF A WHITE-BREAD, MUSCLE MEAT, SUGAR AND POTATO TYPE OF DIET

Dr. Simmonds and I have emphasized for years the significance of two classes of foods, namely, the leafy type of vegetables and milk, as supplements to other foods. This view is now generally accepted as sound. Much effort has been given to popularizing the system of food selection that is based upon the general proposition that any diet consisting solely or nearly so of cereal products, tuber and root vegetables, fruits, muscle meats, and sugar, the latter being a prominent constituent of the diet, will be unsatisfactory for the promotion of growth or for the maintenance of well-being over a prolonged period. I shall not attempt here to state in detail the defects of the white bread, muscle

meat, sugar, and potato type of diet, further than to say that it involves both mineral and vitamin deficiencies. We have pointed out that many of the Orientals who eat much cereal food consume what we should regard as excessive amounts of leafy vegetables. The superiority of dairy products as supplementary foods throughout the Western world and in the dryer parts of the world is now abundantly demonstrated.

MANY MOTHERS DO NOT SUPPLY ENOUGH VITAMIN B TO THEIR BABIES

The question naturally arose some years ago as to how far an unsatisfactory food supply might be significant as a human health problem in America and in Europe. In this country a very significant research has been carried out by Dr. Macy and her associates, Miss Outhouse, Miss Brown and Miss Hunscher, at the Merrill-Palmer School in Detroit. They have clearly shown through a most painstaking research that there is little question that many mothers do not supply enough vitamin B to their babies. They state that at the best the average healthy mother is producing a milk that is exceedingly low in vitamin B. For the economy of the mother's nutrition, and to safeguard her offspring, food materials rich in this important food component should form a prominent part in the diet of pregnant and lactating women. Food substances rich in vitamins, furthermore, should be introduced early in the nursing period of the infant, whether it be breast- or artificially-fed.

It is very significant that they have shown that the lactation requirements for vitamin B are from 3 to 5 times greater than for growth. In contrast to this they find that milk from women on the average American dietary is apparently a relatively rich source of vitamin A. This is doubtless due to the almost universal use of fairly liberal amounts of butter. Their results confirm the view that the diet low in vitamin A is closely associated with the child's susceptibility to infections and to certain eye abnormalities, as well as to other untoward results. In their studies they have had the facilities of the organization developed by Dr. B. Raymond Hoobler, the pioneer in the collection and distribution of the surplus human milk to infants who would otherwise be artificially-fed.

Some years must elapse before our knowledge of human dietary problems will be as complete as we should like. There has been under way during the last three and one-half years a very comprehensive community study under the supervision of Miss Edna N. White, Director of the Merrill-Palmer School at Grosse Ille near Detroit. This study it is hoped will answer a number of the most important questions relating to human nutrition problems.

MALNUTRITION AND SPECIFIC DIET DEFICIENCY

The attention of this Conference should be directed to the fact that we now understand the relation between no less than 7 or 8 specific types of malnutrition and specific deficiencies in the dietary. In addition to those already mentioned I should add osteomalacia, which affects large numbers of women in parts of the Orient and occasionally individuals in other parts of the world, as well as domestic animals in large numbers in certain sections; also nutritional edema, which from time to time has been of great importance as a health problem under conditions of semi-starvation. Mention should also be made of the recent advances in the dietetic treatment of anemia.

DANGERS OF MEDDLING WITH THE DIET OF THE EXPECTANT MOTHER

In conclusion I would like to emphasize that there has been for years and still is too much meddling with the diet of the expectant mother with the objective of producing a child of small size and of promoting easy delivery. All evidence available from animal experimentation indicates the danger of such a procedure. I believe that any dietary regimen that is sufficiently out of balance or defective to produce an observable effect on the size of the child will also injure it and predispose it to weakness in post-natal life. Such a procedure is, if we may judge from the results of observations on animals, more likely to interfere with delivery than to facilitate it.

I should also like to emphasize that whereas there is general appreciation of the gravity of well-marked conditions of deficiency diseases, the full significance of borderline conditions of malnutrition are still largely conjectural.

HOW CAN THE SCIENCE OF NUTRITION BE APPLIED IN THE HOME?

MARY SWARTZ ROSE, PH.D., Professor of Nutrition, Teachers' College, Columbia University

A century and a half ago there was presented to the French Academy of Science a memoir that marked the beginning of the application of science to the problems of human nutrition. Its author, Lavoisier, even in the thrill of measuring for the first time the amount of food being oxidized within the living body of a man, paused to reflect upon the practical significance of his observations, for he wrote: "What fatality ordains that a poor man, who works with his arms and is forced to employ for his subsistence all the power given him by Nature, consumes more of himself than does an idler, while the latter has less need of repair?" At the close of the memoir he expresses a sentiment eminently suitable for a Race Betterment Conference: "To merit well of humanity and to pay tribute to one's country, it is not necessary to take part in brilliant public functions that have to do with the organization and regeneration of empires. The naturalist may also perform patriotic functions in the silence of his laboratory and at his desk; he can hope through his labors to diminish the mass of ills that afflict the human race, or to increase its happiness and pleasure; and should he by some new methods that he has opened up prolong the average life of men by years or even by days, he can also aspire to the glorious title of benefactor of humanity."[1]

Today Lavoisier's dream is being realized. Thanks to him and to a host of his successors, we have knowledge that will, if applied, diminish the mass of ills that afflict the human race. One by one we have discovered the essentials of an adequate diet; a supply of energy for the activities of the organism; protein to meet the need for nitrogen; mineral elements of many kinds; vitamins essential to health, growth and reproduction. Not until we knew all this could we understand the place that our various foods should occupy in the diet. Only within the last twenty years have we realized the very definite control over our well-being that the food eaten day by day and year after year is bound to exercise, and only within the last five years have we developed methods of showing this control so clearly that the children now growing up may see for themselves why some foods are better for them than others, and may learn to make their selection on the basis of this knowledge rather than from tradition or whim.

1. Cited by Lusk, Graham, "Some Influences of French Science on Medicine," Journal of American Medical Association, Vol. 76, page 1, 1921.

A WHITE BREAD AND COFFEE DEMONSTRATION

Today we can go into a schoolroom with two pairs of newly-weaned white rats from one mother, and show the children how we can learn what boys and girls ought to eat by means of an "experiment" whose purpose is to find out whether or not food makes any difference in their health. To one pair we may give a diet of whole wheat bread and milk, and to the other pair white bread and coffee. In the course of six weeks the pair on bread and coffee will be much smaller in size and will have rough fur, often patches where it has fallen out entirely, tails that show a poor condition of the skin, and cold and blue feet that the children quickly note as signs of poor health. This of itself is impressive, but when the bread and coffee rats are changed to the whole wheat bread and milk diet and quickly begin to lose their miserable looks and to gain weight at an astonishing rate, there is no need of discussion of the question, "Does food make a difference in health?"

Knowledge of the factors in food that make for health and vigor is very essential in view of the rapid changes in our food supply, owing to the development of modern transportation, cold storage, and various other methods of food preservation. We have much more choice, and consequently much more responsibility for learning how to choose wisely.

THE DANGERS OF SUGAR

For instance, it is now possible to get almost unlimited amounts of pure cane sugar at a price so low that any one can buy. This coupled with its extreme popularity has resulted in the consumption of ten times as much per capita per year in this country as was customary a century ago. Instead of being a treasured condiment, sugar is now a recognized staple from which are derived approximately one-fifth of the total calories consumed by the people of the United States as a whole. Does sugar deserve this place of ever increasing prominence in the diet?

Science gives a clear answer. It tends to satisfy people's appetites without making any contribution to the upkeep of their bodies. There is a type of malnutrition, most plainly seen in infants, in which there is good body weight, so that the casual observer says, "What a fine child!" The expert in nutrition takes note, however, of the composition of the blood and finds it lacking in hemoglobin; of the bones, and discovers that they are weak and distorted from lack of proper storage of calcium; of the ears and nose, and perhaps finds them the seat of infection. All these things make the child an easy prey to fatigue and disease, and come from the lack of suitable amounts of body-building material in the diet and also of those substances, chiefly mineral elements and vitamins, that serve to keep the body functioning at

its best. The child remains fat because of calories in excess of his needs that he is still able to store; he has too many calories that bring in no protein, mineral constituents or vitamins.

Now sugar furnishes nothing but calories, and when large amounts are taken, the burden of providing the other essentials of the diet falls heavily upon the other foods eaten. One of two courses is open, either to restrict the sugar consumption and make room for other foods of higher value, or to select a few foods that have a high concentration of the needed elements, and to depend upon these to make good the deficit.

SUBSTITUTE WHOLE-WHEAT BREAD FOR WHITE

The situation with regard to our popular highly refined flour is similar. The idea undoubtedly lingers in the minds of many that white flour is a sign of prosperity, because in the past it was not available for every one. Today price is no bar and the only limitation upon consumption is the question of nutritive value. It is not quite so one-sided a food as sugar, because it contains considerable protein and small amounts of some mineral elements, yet its chief contribution to the diet is calories. No animal can grow upon white bread alone.

If now we take one-fifth of our calories from sugar and another fifth from white flour, the burden upon the rest of the diet for the other essentials becomes very great. In the laboratory it is possible to make young animals grow well on a diet in which more than three-fourths of the total calories come from starch (which, like sugar, yields calories only) provided the rest of the ration consists of a special mixture of mineral salts compounded in the laboratory and given in sufficient quantity to meet the animals' needs for such elements, and provided also a few foods which have been found specially efficacious because of their vitamin content are included, such as lettuce and liver, and provided there is some food to furnish protein of the best quality for growth, namely, milk. In other words, we must know that the average of our diet is good. Foods of low value must be reinforced by others that are strong where the low ones are weak. Systematic food education is imperative if we are to adjust ourselves successfully to changing food conditions.

Every one should understand that the substitution of whole wheat bread for white, and of other whole-grain products for highly refined cereal foods, is another safeguard of nutrition that costs practically nothing. Many dietaries are low in iron, and the use of whole wheat bread may easily increase the day's total iron 30 or 40 per cent. Properly prepared whole wheat bread at the present time differs less from white bread in digestibility than is generally supposed, and certainly any loss that occurs is far less than the loss involved in the ordinary

milling process. It is estimated that the body will absorb at least twice as much phosphorus, iron and calcium from a pound of whole wheat bread as from a pound of white. .

MILK THE BEST FOOD INVESTMENT

One of the first objectives in such education is the establishment of the habit of eating certain foods that in large measure insure a well-balanced diet. No single food is so important in this respect as milk. There is abundant scientific evidence that for all ages milk reinforces the diet at more points than any other common article. Its proteins make more useful the very considerable quantity ordinarily derived from the grain products in the dietary; its mineral constituents are well-assorted; it is particularly rich in calcium, in which the American diet is very generally deficient; and it furnishes two vitamins indispensable in human nutrition. In any food budget the first allotment should be for milk, and whatever is spent for it may safely be regarded as the best food investment.

To convince people of this and to persuade them to act upon their knowledge would probably do more to raise the general level of health and vigor of young and old than any other single food measure. That much education is needed is clear from surveys of present practice in regard to milk consumption. According to a report made recently by the American Child Health Association, the average daily milk consumption in 86 cities of the United States with populations between 40,000 and 70,000 was found to be 0.8 pint, while that of 197 towns in 12 states was only 0.58 pint. Now it has been shown by long and carefully controlled experiments on children from three to thirteen years of age that a quart of milk every day is necessary to insure the optimum storage of calcium and phosphorus for the development of the bones and teeth. Other experiments on laboratory animals, carried through many generations, have shown that a liberal allowance of milk, corresponding to a quart per day approximately, greatly increases the vigor of the young adult and postpones the onset of old age. Considering this evidence Sherman says: "Certainly it seems to me that the boy should have his quart of milk per day until he is a man full grown, and the girl should continue to take her quart of milk per day until as a woman she has weaned her last child."[2] The application of the simple rule of a quart a day for every child and every pregnant or nursing mother, and at least a pint for every other adult will automatically rule out many food practices unfavorable to the best health at the same time that it insures the all-round adequacy of the diet as regards essential components.

2. Sherman, H. C.: "The Optimum Amount of Milk for Children." Proceedings of the World's Dairy Congress, Vol. I, page 44, 1924.

VEGETABLES AND FRUITS DIETARY SAFEGUARDS

While the deficiencies of meat, white bread and sugar, which are now constituting too large a proportion of our total food consumption, can be remedied by the use of milk to a far greater extent than most people suppose, we also need, as an additional safeguard, more vegetables and fruits. The opportunities to procure fresh vegetables and fruits nearly all the year round through improved facilities for successful transportation will offset some of the disadvantages of refined flour and sugar if only we will take the pains to use them. The richness of green leaves in vitamins and mineral salts gives them a place almost as distinctive as that of milk. We must depend upon fruits and vegetables for the vitamin that prevents scurvy and that is easily destroyed by heat. For this reason our food education should include instruction in the value of citrus fruits and tomatoes (the latter whether raw or cooked) and of raw vegetables, such as cabbage, carrots and turnips, as well as lettuce and other so-called "salad greens." Science has also taught us that the methods of cooking vegetables in the home need to be improved; that the custom of adding soda should be abandoned, and that the time of cooking should be reduced very much.

MEAT A VERY ONE-SIDED FOOD

The diets of most Americans would be improved if their meat and sugar consumption were each cut in two. We know today that meat is a very one-sided food, needing to be supplemented by milk, fruits and vegetables, for calcium and vitamins. No young animal will grow normally on a diet of white bread and meat. The contrast between the results of feeding white bread and meat and white bread and milk is so striking that we can use it in teaching even young children. To make the demonstration complete, we must feed also a mixture of bread, milk and meat, and show that we get practically the same results with whole wheat bread and milk alone as with meat added.

HOW TO APPORTION THE FOOD MONEY

Another way of applying our knowledge is to apportion the food money with regard to the nutritive properties of different types of food. The following has been suggested by Sherman:

"Divide your food money into fifths:

One-fifth, more or less, for vegetables and fruit;
One-fifth, or more, for milk and cheese;
One-fifth, or less, for meats, fish and eggs;
One-fifth, or more, for bread and cereals;
One-fifth, or less, for fats, sugars, other groceries and food adjuncts."[3]

3. Sherman, H. C.: Chemistry of Food and Nutrition, 3rd Edition, page 559, 1926.

THE DISTRIBUTION OF CALORIES

Now that calories have become a household word, housewives generally are equipping themselves with reference tables that make the setting up of a "food budget" in terms of calories a simple matter. As has been pointed out, those foods that contribute calories only, such as sugar, must not crowd out foods that also contribute proteins, or mineral constituents, or vitamins. In a family dietary, a good distribution of calories is the following:[4]

Class of Food	Per Cent
Foods from cereal grains (including bread)	25–30
Milk	25
Vegetables and fruits	15–20
Fats and oils	10–20
Sugars	10–12
Meats, eggs, fish, cheese, etc.	8–15

In using a scheme like the one indicated above, it should be understood that the vegetables and fruits are to be chosen with some regard to variety, so that green vegetables, tomatoes, potatoes, and others—according to season and locality—will be included in the vegetable quota, and that the dietary will further be enriched by the use of whole-grain cereal preparations up to at least one-half of the calories allotted to cereals.

Nutrition as a science is not very old, and we have scarcely begun to realize what it may do for the human race. But we have abundant evidence already that better teeth, better digestion, less susceptibility to fatigue, more freedom from skin disturbances and from infections of the ears and nose frequently result from improvements in eating habits. Improvement in rate of growth and general vigor and delay in senility will not be in evidence so soon, but our laboratory experiments, extending over many generations, give us faith to believe that "all these things shall be added unto us" if we will but follow where science leads.

4. Rose, M. S.: Foundations of Nutrition, page 434, 1927.

PROGRESS IN VITAMIN RESEARCH

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Toward the end of 1926 J. C. Drummond summarized the studies of vitamin isolation and concentration as follows:

Vitamin	Minimum Protective dose in milligrams	Weight of test animals in grams	Dose for 100 grams per animal	Preparation by
A	0.01	100 gm. rat	0.01 mgs.	Drummond
B	0.08	300 gm. pigeon	0.027 mgs.	Peters
C	0.45	300 gm. g. pig	0.15 mgs.	Zilva
D	0.10	100 gm. rat	0.10 mgs.	Rosenheim & Webster
E	0.50	200 gm. rat	0.25 mgs.	Evans & Burr

During the past year (1927) this table has undergone some modification. From Java has come the announcement by Jansen and Donath of the isolation of an anti-neuritic vitamin (B) in crystalline form with a potency of 0.02 milligrams per day for bondols (a rice bird) and 0.06 mgs. per day for pigeons. From Rosenheim and Webster working in collaboration with Windaus has come the announcement that vitamin D is ergosterol and that when pure ergosterol is activated by ultra-violet rays its potency is 0.0001 mgms. per rat per day.

The extremely small size of such doses makes it evident that progress is on in the direction of vitamin isolation and chemical identification and also that our European colleagues are apparently outstripping us in this particular race. The values cited are not, however, to be accepted without question, and I would like first to review some of this recent work.

VITAMIN A

In 1925 a group of Japanese workers (Takahashi, Nakamiya, Kawakami, and Kitasato) announced the separation from cod liver oil of a sterol to which they gave the name "biostearin" and the chemical formula $C_{27}H_{44}O_2$. With it, they were able to restore growth in rats deprived of vitamin A by dosages as low as 0.001 mgs. and to cure xerophthalmic rats with dosages of 0.015 mgs. When, however, the dosage was increased to 0.125 mgs. per day, the compound was so toxic as to kill the animal. The implication was that biostearin was pure vitamin A and that overdosage of A might produce toxic effects, although previously no such overdosage of a vitamin had been found

harmful, and our teaching had been that while we require a certain amount for health protection, we need not fear harmful effects from amounts in excess of that requirement.

Repetition of the Japanese work by Drummond led him to question the purity of biostearin and to attribute its toxic effects to the presence of these impurities rather than to overdosage of vitamin. His work also stimulated review of previous studies by Nakamiya and Kawakami. In a paper published by the latter under date of October 20th, 1927, they say: "The elementary composition of this substance (biostearin) was proved to be approximately: C = 81.0 per cent, H = 11.0 per cent, O = 8.0 per cent, corresponding to the empirical formula $C_{27}H_{44}O_2$. It was supposed to be a secondary alcohol closely related to cholesterol. But unfortunately, the biostearin so obtained was a syrupy mass, even when cooled at — 75°, and neither its derivatives nor its decomposition products could be prepared in crystalline form. Moreover, it was very unstable and its specific activity was gradually lost by oxidation or long preservation. The authors thus had no means of deciding upon its absolute purity."

With this admission the authors then proceed to report attempts made to determine the components of biostearin by converting it through hydrogenation and distillation into separable components. Such attempts separated it first into a major and minor fraction. The latter, a crystalline mass constituting about 5 per cent of the whole, resolved itself into four or five identifiable compounds having apparently no relation to vitamin A (nonocosane, m.p. 62-63° C; butyl alcohol, m.p. 58° C by N and 62° C by K; and in N's fractions octadecyl palmitate, m.p. 59° C; melissyl alcohol, m.p. 84° C, and an unknown saturated alcohol, m.p. 89° C).

The most part of the hydrogenated biostearin (90-95 per cent) was in liquid state, and the authors could separate it into two main portions by distillation. One fraction contained more than 80 per cent carbon and 12-13 per cent hydrogen; the other fraction about 77 per cent carbon and 12 per cent hydrogen. The latter distils at a higher temperature and may correspond to the fraction Drummond estimated as the active component. Drummond assigned to his fraction the formula $C_{20}H_{36}O_2$ (C = 78 per cent, H = 11 per cent). In none of their fractions did they find any squalene, reported by Drummond as at least 8 per cent of crude biostearin.

Since, however, hydrogenation completely destroys vitamin A activity, if complete, according to the Japanese workers, there is no way to date of deciding whether or not any of these fractions are the true vitamin A, for none as prepared showed any appreciable physiological effect. We know today, then, that hydrogenation destroys the specific

activity of biostearin, but nothing as to the true nature of vitamin A other than that it was present in the undivided biostearin.

Meanwhile, the development of a color test for vitamin A in cod liver oil that correlates well with feeding tests offers a possible tool for the chemical identification, but we are still remote from absolute isolation of that vitamin.

VITAMIN B

The work of Smith and Hendrick, Goldberger and coworkers, and others in this country, has effectually demonstrated at least the duality of what we have been wont to call vitamin B. That duality has been further confirmed by Peters in Oxford, by Jansen and Donath in Java and by Williams working in my own laboratory. Chick and Roscoe utilized the Peter's fraction in demonstrating the Goldberger hypothesis. What precisely have Peters, Jansen and Donath and Williams done?

In brief, starting with baker's yeast, Peters and Kinnersley have been able, by controlling the selective absorption of the charcoal norite, to separate a fraction that in doses of .08 milligrams per day prevents the phenomenon of head retraction of pigeons from occurring in a given period of days (Peters' definition of dosage) and which in the hands of Chick and Roscoe would prevent poly-neuritis in rats, but would not prevent pellagra symptoms or produce normal growth, unless combined with autoclaved yeast. To avoid confusion in nomenclature, Peters uses for this fraction the old name of Eadie, viz., "torulin."

Williams has, by controlling the absorption of Fuller's earth, secured a potent concentrate that resembles Peters' fraction in preventing poly-neuritis in pigeons and requiring supplementation with autoclaved yeast to prevent pellagra symptoms or to produce normal growth in rats. Williams' fraction in combination with autoclaved yeast apparently meets the entire B requirement of rats. When pigeons are fed on either synthetic and otherwise complete diet but lacking vitamin B or on polished rice alone, poly-neuritis is prevented by the Williams fraction and some growth restoration occurs. Rarely is this restoration complete, even with a dosage far above that necessary to prevent poly-neuritis. Furthermore, addition of autoclaved yeast to these diets in combination with Williams' fraction fails to make the restoration, though such restoration is prompt with either dried or fresh yeast or with whole grain. These results have led to the postulation of a third heat labile factor in the vitamin B complex, essential to pigeon weight maintenance.

The confirmation of Jansen and Donath's claim to have isolated a crystalline anti-neuritic would go far toward resolving our doubts as to the identity of Peters' torulin and Williams' fraction. Peters has to date reported inability to make the J. & D. method produce crystalline

product from his concentrates, and suggests that the reason may lie in the difference in raw materials used, as their isolation was from rice polishings. We are at present studying their method as applied to the Williams fraction (like Peters prepared from yeast, but brewer's instead of baker's). To date we can only say that, following the method rigorously, we have obtained a yield of crystals. These crystals have in the doses stated by them proved entirely incapable of preventing poly-neuritis or of restoring weight in pigeons, but we may have less potency than they reported and are far from feeling to date that the results negate in any way their claims. In fact, up to the crystal stage the fractions have behaved exactly as they describe, except that our losses far exceed theirs. We are actively pursuing this study at present and are much impressed with their technique.

While here, then, as in the case of vitamin A, the certainty of isolation or at least of isolation method must be held as yet unattained, we have at least a separation of the P-P factor of Goldberger from the anti-neuritic fraction, and a possibility of revision of existing estimates of vitamin B potency in natural foodstuffs. Using the Williams fraction and autoclaved yeast as tools, we have retested spinach and bananas, and have shown that the P-P factor in these is definitely in excess of their anti-neuritic factor content. Others have shown, on the contrary, that certain whole cereals and their embryos possess greater anti-neuritic than anti-pellagric value. Before attempting general revision of existing vitamin B values along these lines, it seems to me wise to hold them in abeyance a bit pending more definite information on the true complexity of the vitamin B complex.

VITAMIN C

From the practical viewpoint, the demonstration that vitamin C destruction in foodstuffs is best avoided by eliminating opportunity for oxidation is of outstanding importance. The application of this principle in the pasteurizing of milk and in commercial canning alone has conserved the food value of products so treated. The query still exists, however, as to whether oxidation actually converts a substance called vitamin C into an inactive modification of that substance.

Recent work by Zilva at the Lister Institute bears on this point but apparently increases the difficulty in answering it. Zilva found that when he concentrated his decitrated lemon juice, the potent concentrate retained the power of reducing ammoniacal silver nitrate and phenol-indo-phenol. Through a clever series of tests, he has been able to show that the reducing agency in the concentrate is at least in part something other than vitamin C, although perhaps essential to the stability of the latter. I refer to only one test of several that led to this

conclusion. He was able to show that whereas ammoniacal lead acetate throws down practically all of the physiologically active vitamin between PH 5.4 and 7, a considerable fraction of non-active but reducing substance precipitates at a PH less than 5.4. Furthermore, while alkalinity quickly reduces antiscorbutic potency and reduction potency in a concentrate showing both substances susceptible to PH control and undifferentiated by this procedure, a juice from which the reducing agency has been eliminated loses its antiscorbutic potency much more rapidly than when allowed to exist with the reducing agency unimpaired. Zilva also finds his physiologically potent fractions always to contain certain ions (Fe, P, etc.) and believes these ions concerned in the physiological effect. This work opens anew the problem of the nature of vitamin C. Is it a single substance or a system of substances, all necessary to the ultimate activity we call scurvy prevention? Besszonov and Randoin in France have independently reported observations suggesting the duality of vitamin C. More chemical data are obviously necessary before we shall have the answer to many practical problems involving the conservation of antiscorbutic power.

VITAMIN D

It was first shown by McCollum in this country that vitamin D was a factor distinct from vitamin A and a component of the non-saponifiable fraction of cod liver oil. Cholesterol therefore early challenged attention as the possible provitamin that could be activated by ultraviolet irradiation. The widespread distribution of this provitamin was evidenced by the studies of Steenbock and Hess and their almost simultaneous announcement of the power of ultra-violet light to make antirachitic a wide range of foodstuffs. But the more cholesterol was studied, the more it became evident that this sterol when fully purified was not the precursor of vitamin D. The explanation seems now to be available through the work of Rosenheim and Webster working in collaboration with the master of sterol chemistry, Windaus. In brief, associated with cholesterol in natural products there exists another sterol, so like it as to make difficult its ready separation, known as ergosterol because of its relative abundance in ergot. The authors just cited have purified ergosterol and shown that when activated by ultraviolet rays it is potently antirachitic for rats in dosages as small as 1/10000 mgs. per rat per day. Inactive ergosterol shows absorption bands that disappear on irradiation. There seems today little reason to question the claim that vitamin D is activated ergosterol, although how irradiation activates it and how and when it functions in rickets prevention is still a problem.

VITAMIN E

As in the case of A and D, we are here apparently concerned with another sterol, and Evans and Burr are still the pioneers in the chemical study of this fraction but without as yet the satisfactory postulation of a formula.

STANDARDIZATION OF BIOLOGICAL TEST METHODS NEEDED

We have enjoyed for some time in this country the distinction of extensive and significant contribution to the rôle of vitamins in nutrition. As one reviews the chemical status of vitamins, one cannot help feeling, however, that many of our hypotheses rest on inadequate and superficial observations. We still lack adequate standardization of biological test methods, and observations of different investigators are often in conflict for this reason alone. The pathologists have to date not adequately cooperated in defining the symptoms of deficiency diseases. We speak glibly, for example, of scurvy, poly-neuritis, pellagra, rickets, etc., in rats, birds and guinea pigs, but without data as to the limitations of symptomatic signs. One group of observers may dismiss the potency of antirachitic foods by basing his conclusions on ash per cents in bones, whereas our observations tend to show that if the so-called line test is a true index of severity of rickets, sub-acute rickets is not satisfactorily differentiated by bone ash per cents. One reason for our failure to determine the identity of Peters' torulin, Jansen and Donath's crystals, and Williams' fraction is that Peters measures dosage potency by amounts necessary to prevent head retraction in pigeons for 25 days, while Jansen and Donath hold that because a solution restores a poly-neuritic bird such data are utterly unreliable proof of anti-neuritic vitamin content when taken alone. Our own results with Williams' fraction show that rats and birds differ markedly in weight response and paralytic phenomena under a given dosage, while Drummond raises the question as to whether our recognized signs of beri-beri are not partly at least due to inanition.

Wollbach and Howe have recently formulated a hypothesis as to what precisely vitamin C supplies. If, as they state, the absence of vitamin C means failure to provide the material necessary to form inter-cellular cement material, we may be able to come to a common histological basis of delimiting scurvy and sweep aside general symptoms of perhaps complex origin.

It would be easy to carry further this discussion of gaps in our knowledge of vitamin nature and action. It is pleasing to proclaim scientific advance and to eulogize contributors. My purpose today is not to criticise or to belittle the splendid achievements of the past dec-

ade in vitamin study in this country, but the present is no time for complacency or for resting on laurels already won.

Broadly, past work has already safeguarded the public from vitamin deficiency in diet. Perhaps it has even attracted too great public attention to the satisfaction of vitamin requirements, for vitamins are after all only a very limited feature of adequate nutrition. We still lack, however, a sound vitamin therapy and will continue to lack it until the chemical nature of these compounds is established, their behavior clearly defined and human requirements quantitatively measured. To do this work demands the cooperative effort of organic chemists, physical chemists, pathologists, biochemists and physiologists. Much of the work to be done may well seem remote from spectacular contribution, for even the reagents used in fractionation need standardization and interpretation. Such work is laborious, slow and often lacking in applause, but tremendously essential. It is necessary in order to raise vitamin prescription from empiricism to science. The year 1927 has advanced this fundamental work materially. May 1928 see still further advancement of such studies and a still greater American contribution thereto.

DEFICIENCIES IN THE AVERAGE AMERICAN DIET

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The term "average American diet," as it is used here, may have two meanings. First, it may refer to the foods that are available for consumption; and, second, it may refer to the actual diet of the average man or family. Figures showing the amount of foodstuffs available for consumption are derived from the production, export and import statistics published by various agencies. When these figures are divided by the population of the United States, they show the amount of food available for one adult-male unit or for an individual. This may be called the average American diet, but such a division of foodstuffs assumes that the distribution is equal throughout the United States and throughout all classes—a situation that we know does not exist.

The term "average American diet" is more commonly used when referring to the diet of the average man or family. The method of obtaining such statistics is based on the collection of food consumption figures from families that are chosen as representative of a given group. In some of these studies, all food that is eaten by the family is carefully weighed and recorded. In others, the housewife estimates the amount of the various foodstuffs used by her family during a given time, usually a year. The former gives results that are more accurate, but the latter method has been more widely used because it enables the investigator to study a greater number of families, and some investigators think that this gives results that are more nearly typical of conditions. Both kinds of diet, the foodstuffs available for consumption and those actually eaten by the American family, are included in this study of the deficiencies in the average diet.

For figures showing the amount of food available for consumption, we are dependent on Raymond Pearl. He estimated such figures for the seven years, 1911 to 1917. He included all the foods that are commonly found in the American diet, and in order to make them comparable, he reduced them to the three nutrients, fat, protein, and carbohydrate, and calculated the amount of energy furnished by each. He then divided these figures by the number of adult-male units in the United States, and expressed the final results in terms of the amount of nutrients and energy available per man per day. The figures for the seven years are quite similar. According to Pearl, the average amount of energy available during this time was 4300 calories. He estimates

that about one-fourth of that was wasted in the course of distribution and in the individual households. This gives a figure in harmony with our accepted energy standards.

HALF OF OUR ENERGY REQUIREMENTS SUPPLIED BY CEREALS AND SUGAR

The foods as listed by Pearl are grouped in such a way that it would be difficult to study them directly for nutritional deficiencies, but a comparison of the distribution of energy among the various food groups as shown by him with a standard that has been found to be satisfactory will indicate some of the deficiencies of this diet. Caroline Hunt has estimated that a diet in which 25 per cent of the calories are furnished by cereals, 14 per cent by meat and eggs, 20 per cent by fruit and vegetables, 10 per cent by sugar, 20 per cent by fatty foods, and 11 per cent by milk and cheese, yields all the necessary nutrients if the energy need is met. If we assume that the waste estimated by Pearl is shared equally by all the food groups, we find that 34 per cent of the total calories available in the United States in 1911 to 1917 was derived from cereals instead of 25 per cent, 16 per cent from meat and eggs instead of 14 per cent, and 13 per cent from sugar instead of 10 per cent, as suggested by Hunt. The fruit, vegetables, and fatty foods available for consumption were lower than Hunt's standard. Only 7 per cent of the total calories were furnished by fruit and vegetables instead of 20 per cent, and 18 per cent by fats instead of 20 per cent as recommended by Hunt. The milk and cheese available for consumption met Hunt's standard.

THE AVERAGE DIET LOW IN MINERALS AND VITAMINS

According to Pearl, therefore, almost 50 per cent of our energy was yielded by cereals and sugar, foods low in minerals and vitamins, whereas Hunt suggests that 35 per cent of the energy be derived from these foods. Milk, fruit, and vegetables, on the other hand, furnished 20 per cent of the energy while the standard for these foods is 30 per cent. Since they are our important source of minerals and vitamins, we are probably justified in assuming that the average American diet, as shown by these figures, is low in certain minerals and vitamins. The figure given by Pearl for meat and eggs is somewhat higher than the standard. The amount of efficient protein available for consumption is apparently adequate to meet the need of the American people.

WORKMEN'S DIET LOW IN CALCIUM AND IRON

So much for the deficiencies of the average American diet as shown by figures derived from production, export, and import statistics. If we now turn to see what has been done during the last 40 years to study the food actually consumed by the average family, we

find that the amount of data that have been collected is large, but the analyses made of the figures are almost negligible. Of the available 30,000 records that show what American families are eating, not more than 2 per cent have been adequately studied for possible deficiencies. Sherman and Gillett in 1915 made a careful study of the food actually consumed by 92 workingmen's families during a week. They found that, on the whole, the protein and phosphorus of the diet were adequate, but calcium and iron were low in many of the diets. Since little was known about vitamins at that time, no attempt was made to include them in the analysis.

The results obtained by the United States Bureau of Labor Statistics in 1918-19, in its study of the food habits of the workingman's family, are similar to those of Sherman and Gillett's. The methods used in the two studies are quite different. The food consumed for one week by the families studied by Sherman and Gillett was carefully weighed, whereas in the study made by the United States Bureau of Labor Statistics the figures are based on the housewife's estimate of the food consumed by her family during the previous year. This study included approximately 12,000 families, or 120 times as many as Sherman and Gillett included. An analysis of the figures published by the bureau indicates that the average workingman's family is consuming food yielding only 85 per cent of the energy that it needs. The minerals are also low. The diet furnishes only 95 per cent of the calcium and phosphorus that is needed and 85 per cent of the iron. The protein, on the other hand, is slightly above its estimated need. If the amount of milk, vegetables and fruit in the diet may be regarded as an indication of its vitamin content, it is safe to conclude that many of these essential factors are also low, for milk, cream, fruit, and vegetables furnished only 22 per cent of the total calories instead of 31 per cent as recommended by Hunt.

DIETS OF FARM FAMILIES INADEQUATE IN MINERALS AND VITAMINS

The situation among farm families seems to be somewhat better than that among the workingmen's families. The United States Department of Agriculture has collected estimates of the food consumed by about 5,000 farm families. The method used was similar to that used by the Bureau of Labor Statistics. From an analysis of these records, we find that the average farm family is apparently consuming considerably more food than it needs. This is true of all the nutrients. When the individual diets are studied, however, we find that 30 to 40 per cent of the families are on diets inadequate in phosphorus and iron. There may also be certain vitamin deficiencies, for the amount of fruit and vegetables consumed is oftentimes low.

All of the statistics that are available point to the same deficiencies —minerals and vitamins. According to production figures for the seven years, 1911 to 1917, more meat and cereals were produced than we as a nation needed, but not enough vegetables and fruit were produced to supply the necessary minerals and vitamins. According to recent figures given in the Yearbook of the U. S. Department of Agriculture, however, this supply is being increased. The amount of lettuce, for instance, shipped into the leading markets of the country has more than doubled during the last five years. The same is true of a number of other vegetables. The milk production is probably adequate to meet our needs, but the distribution among the different income groups is quite unequal.

From these figures it appears that the foodstuffs are, on the whole, available. But if the surveys that have been made are at all representative of the food habits of the families of workingmen and farmers, we get a good picture of the inequalities in distribution. These two industrial groups make up about three-fourths of the people living in the United States. This means that probably 40 per cent of them, or approximately 30 per cent of the total population, are living on diets low in some of the minerals and most of the vitamins.

INCREASED KNOWLEDGE OF FOOD PREPARATION NEEDED

The situation is not one of underproduction so much as one of ignorance. In order to correct these deficiencies the first step is, therefore, the education of the consumer in food, its nutritive value, its preparation, and its economics. The facts of nutrition should be expressed in simple terms that the layman can understand. There is probably no one subject upon which more misinformation is being given out at the present time than on foods. In addition to facts pertaining to nutrition, the housewife should be taught methods of food preparation that favor the retention of all the nutrients. Also she should be taught that our present methods of food refining introduce nutritional and economic losses that we can ill afford. When she realizes, for instance, that the materials that are now being removed from such cereals as wheat and rice contain many of the nutrients of which she is being deprived, she will demand that some way be found to make them suitable for human consumption instead of permitting them to be wasted or to be used wholly for animal feeds.

CONSUMER SHOULD DEMAND MORE EFFICIENT MARKETING SERVICE

When the consumer has learned the essential points pertaining to food and then creates the demand for suitable food, the necessary production of them will naturally follow. But the adjustment of the

distribution or marketing process to the consumer's needs is not so simple. One of the causes for deficiencies in the diet is insufficient income to meet all of the family's needs. Little has been done, however, to study the marketing process from the consumer's point of view to see just what it contributes to his cost of living, and yet for many foodstuffs more than half of the consumer's dollar goes to meet the demands of this service. Much has been written on marketing, but it is largely for the purpose of teaching those engaged in the work how to make it more profitable. It is time that we begin to study the value of the various agencies to the consumer. Is there duplication of service, for instance, that we as consumers should eliminate? Four or five similar brands of cereal are placed on the market and the manufacturers or their agents put forth every effort to induce us to use as much of their own particular product as possible. Is such a situation advantageous to the consumer? Does the heavy selling pressure that is used increase the cost of his food? How much advertising is useful and how much is a needless waste? There are many such questions that we cannot answer. And before we can teach the consumer to demand more efficient marketing service from the point of view of value, careful study of the process will have to be made to determine what is of value and what is sheer waste.

COD LIVER OIL AND ITS ROLE IN HUMAN NUTRITION

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Authentic record of the use of cod liver oil in the treatment of human ills dates back to 1766. A patient in the Manchester Infirmary in England being treated for rheumatism was advised to use cod liver oil. It effected a rapid cure. No particular attention was given to the use of the oil because it was thought that medicine given and other factors were probably operative in the recovery. A year later the trouble recurred, and the same cod liver oil treatment was again effective. In a book on the treatment of tuberculosis by Albert Robin, he states, "Jaccoud considers cod liver oil as the most powerful agent in the pharmaceutical treatment of pulmonary phthisis, and the more than secular vogue it has enjoyed, since Percival advised its administration in 1770, is still confirmed in the practice of the greater number of medical men."

In 1771 Percival entered it in the British Pharmacopea.

In a paper by Guy on "The History of Cod Liver Oil as a Remedy," we are told that no mention is made of this oil in English medical literature from 1807 to 1841, but that it was being used as a family remedy. Its use in the treatment of rickets, scrofula, rheumatism and gout during this interval is recorded in Dutch and German medical journals. In 1824 Schutte published the first definite case histories of rickets cured by cod liver oil, stating that he had used it for 25 years. The use of the oil spread and continued, but it was not until the present decade that its value as we know it became established.

The earliest method of preparing cod liver oil commercially was the "rotting process." Livers were put into casks or other suitable containers to permit their disintegration, and the oil that rose to the surface was removed. The first oil obtained, called pale oil, and a second crop, called light brown oil, were used medicinally. A third crop, called brown oil, was obtained by heating, but this oil was used for purposes other than human consumption.

About 1850 the steam jacketed kettle for oil rendering was introduced. In this process the livers are subjected to heat, about the temperature of boiling water, until the oil comes to the surface.

IMPROVED METHODS OF MANUFACTURE INSURE MORE VALUABLE PRODUCT

In the modern manufacture of cod liver oil the use of direct steam has largely replaced the steam jacketed kettle. The livers are placed in a kettle having the shape of an inverted cone. Steam under pressure

is forced in at the bottom until the livers are disintegrated, and the material is then allowed to stand for from 20 to 30 minutes to permit the oil to rise to the surface. The oil is either drawn off from spigots on the side of the kettle or dipped off of the surface and filtered. It is cooled to a freezing temperature and the fats that crystallize out, technically called stearin, are separated from the liquid oil. This oil is then ready for bottling or putting into larger containers for convenient shipping.

The residue after steam rendering is subjected to the rotting process, and the quantity of oil so obtained is equivalent to about 20 per cent of the original extraction. This is the so-called cod oil which is used principally in the leather industry. The livers are rendered on shipboard when fishing is carried on from ocean-going vessels, and on shore when the fishing grounds are close at hand. Oil with the least disagreeable taste or odor can be obtained only from fresh livers, so that most livers are rendered within a few hours from the time the fish are caught.

The therapeutic value of the oil is dependent in part upon the manner in which the livers and oil are treated, and improved methods of manufacture have done much to insure a more desirable product.

The extent to which the cod liver oil industry has grown can be gained from the following figures: In 1926 cod liver oil and cod oil valued at more than $3,000,000 entered this country. The two million gallons of cod liver oil, valued at one dollar a gallon, were used principally for human and animal consumption. The medicinal oil in small bottles retails at from five to ten dollars a gallon. The demand for cod liver oil is at present in excess of the supply, and the wholesale price has gone from $1.00 to $1.50 per gallon during the past year. This condition has been brought about largely by the increased use of the oil in animal feeding, principally poultry, and an abnormally low catch of cod fish in Norway.

A SOURCE OF VITAMINS A AND D

Cod liver oil has gained its present important position largely because of its being an excellent source of two substances called vitamin A and vitamin D, which are necessary for normal growth and well-being. The rôle played by vitamins in normal nutrition has been established principally by studies with animals. If the diet of a young rat is made satisfactory in every respect except for vitamin A, a soreness of the eyes becomes manifest in a few weeks. There is a swelling and redness of the lids, which is followed by infections, and ultimately by destruction of the tissues of the eye. Accompanying this condition there are changes of the epithelium of the respiratory tract, leading to

infections. In the early stages of these symptoms, a small quantity of vitamin A in the diet will cause their rapid disappearance.

If a rat is put upon a diet that is deficient in vitamin D, and the proportion of calcium and phosphorus has been so adjusted that they are present in a ratio quite different from the ratio in which they are used by the body, there develops in the course of a few weeks a disease known as rickets, characterized particularly by incomplete calcification of the bones, skeletal deformities, and flabby musculature, a condition that leads to decreased activity and awkward movements of the animal. This disease can be prevented or cured by including vitamin D in the diet.

SUCCESS WITH COD LIVER OIL IN RICKETS

The term rickets was probably first used by Arnold de Boot and is derived from the old English word, "wrickken," meaning to twist. The more technical term, rachitis, Greek for the spine, was used by Glisson, who in 1650 described the disease we know as rickets. It occurs chiefly in infants, more frequently before the child is able to walk than afterward, and more frequently in artificially than breast-fed babies. The most easily recognized conditions that are the result of rickets are "bowed legs," "knock knees," and the deformed thorax commonly referred to as "chicken-breasted." The "chicken-breasted" condition may be a predisposing factor in the causation of pulmonary infections, as parts of the lungs not able to function normally owing to restricted space become the foci of attack. In female infants one serious aspect of the skeletal deformities is that concerned with the pelvis, which may be affected to the extent that normal parturition may be interfered with or prevented, and resort to Caesarean section may be necessitated.

Progress in establishing the etiology of rickets was very slow, and not until the present decade were conflicting views brought into harmony. It was not until fifteen years ago that experimental animals could be grown to maturity on diets so constituted that the chemical composition of most of the ingredients was known. The empirical use of cod liver oil had met with success, but attempts to establish what components of the oil not found in most other fats or oils were operative in this success were so unavailing that skepticism in regard to its merits had become prevalent.

The confusion that existed in the medical profession in 1908 with respect to the cause of rickets is well exemplified in a statement by a leading investigator of that time. "Many and varied have been the causes assigned for rickets. Almost every prejudicial circumstance in the life of the infant—and in the parent, too, for that matter—has been cited as the etiological factor." Among the causes to which the disease

has been ascribed are heredity, incorrect feeding, bad hygiene, want of sunlight, defective calcium metabolism, infection, syphilis, and lack of exercise. Attempts to produce experimental rickets did not meet with uniform success, but between 1910 and 1920 two schools grew up in England, one supporting the view that the cause was of dietetic origin and the other maintaining that hygiene, sunlight, and exercise were of prime importance in the prevention and cure of the disease.

ULTRA-VIOLET LIGHT IN THE CURE OF RICKETS

In 1919 it was demonstrated that ultra-violet light treatment alone would cure rickets, and a year later it was shown that the direct rays of the sun were also effective. Shortly afterward the successful development of rickets in rats, found to be dependent in part on the calcium and phosphorus ratios in the diet, and a technique for testing the antirachitic activity, led to the demonstration of the presence in cod liver oil of a substance that was specific for the cure of rickets, and that was different in its chemical behavior from the known constituents of the oil. Two years later the conflicting views with respect to diet and hygiene being causative factors were brought into harmony by the demonstration that ultra-violet light, artificially produced or from direct sunlight, would impart to certain foods antirachitic properties.

SIX VITAMINS CONCERNED IN SPECIFIC ABNORMAL PHYSIOLOGICAL CONDITIONS

Studies in nutrition received a tremendous impetus in 1913 when investigators in this country demonstrated that experimental animals would grow to maturity on a simplified diet. At present we know that in addition to proteins of satisfactory quality, energy producing foods, and mineral elements, there must be present in a complete diet certain unidentified components known as vitamins. Evidence has been presented to establish that there are six of these substances, each of which is concerned in the prevention or cure of a specific abnormal physiological condition: Vitamin A, xerophthalmia; B, beriberi; C, scurvy; D rickets; E, sterility; and the so-called P-P factor concerned with pellagra. As the existence of the antisterility factor, vitamin E, has been demonstrated only on experimental animals, the rôle it plays in human nutrition cannot be foretold, but the requirements for all of the other vitamins must be met for the normal growth and well-being of man.

It is not the purpose of this paper to stress the importance of including these substances in the dietary, or to explain in detail the results in their respective deficiencies, or to summarize what is known of their properties or distribution. It can be said that nature has

provided these substances in abundance, but that in highly civilized nations desirable practices in preparing immense quantities of food materials for intensely populated areas has, in some instances at least, led to undesirable dietary habits, and forced us to take cognizance of all the essentials that constitute a satisfactory diet.

The result of a deficiency of vitamins A and D has been described. A few words regarding the extent to which the diseases caused by their respective deficiencies have occurred may be apropos: Fourteen hundred cases of an eye disease in Japanese children that were cured by the administration of liver (chicken and fish) and eel fat were reported in 1904. In 1906, cases of eye disease probably of dietary origin occurred in malnourished children in Germany. In 1917, a severe outbreak of xerophthalmia of dietary origin occurred in Denmark.

We know that rickets has been prevalent for centuries. Five years ago we were told by men who have been active in the clinical treatment of the disease that from 50 to 90 per cent of the children in some of the large cities in this country and central Europe suffer from rickets to some degree.

Cases of xerophthalmia in man are comparatively rare, and seldom occur except under unusual circumstances, such as those imposed by war or famine. There is, however, the possibility that lack of vitamin A may be a predisposing factor in some respiratory infections. As dairy products and green leafy vegetables can supply this factor in satisfactory quantities, it is probably only in the case of some artificially fed children, and in diseases such as tuberculosis, that cod liver oil administration may have a distinct advantage.

Rickets, a disease of infants of the temperate zone, can be controlled by sufficient direct sunshine, artificial ultra-violet light, or foods exposed to ultra-violet light.

The fact remains that cod liver oil has established itself as a valuable therapeutic agent. Because of its extensive use, it was deemed advisable to obtain further information on the vitamin content of oils being offered to the public. Reliable information can be obtained at present only by biological tests.

THE VITAMIN POTENCY OF COD LIVER OIL

About a year and a half ago the Protein and Nutrition Division of the Bureau of Chemistry and Soils, in cooperation with the Drug Control Laboratory of Food, Drug and Insecticide Administration of the United States Department of Agriculture, began an investigation of the vitamin potency of cod liver oils and preparations alleged to be made from them. At present we have data on about forty of these

products. We find in general that medicinal cod liver oils adjudged by chemical and physical tests to be pure do not vary greatly in their antirachitic value. Tests reveal oils that have only one-half to one-third the quantity of vitamin D usually found, but in every such case chemical analysis has indicated adulteration with other fish oils. Some oils unquestionably adulterated have been found to be equal in vitamin content to the best genuine cod liver oils. Variation in the vitamin A content of oils examined to date has been considerably greater than variations in the vitamin D content, but some oils that were apparently adulterated had a vitamin content equal to that of the best genuine cod liver oil.

With respect to preparations alleged to contain concentrates of the active principles of cod liver oil, not one whose examination has been completed to date has been found that contains significant quantities of A, and only one that meets its claims for D. Fully one-half those examined are valueless from a therapeutic standpoint.

It is possible to obtain from cod liver oil a fraction, representing about one per cent of the original oil, that contains practically all the vitamins. The failure of manufacturers of proprietary preparations to put out a satisfactory product can probably be attributed to a failure to appreciate the instability of the vitamins under certain conditions, failure to control technical operations by the necessary tests, or possibly a lack of sincere effort to produce a genuine product.

Our vitamin investigations are being continued, and will probably be extended to other fields with the hope that this work will result in the production and distribution of improved products, and that the consuming public will be benefited accordingly.

THE GORILLA AND ITS ENVIRONMENT

Mrs. Carl E. Akeley

("A few days in the gorilla country and one instinctively falls into the way of referring to this amiable giant as 'he,' in the human sense. A few weeks of casual acquaintance and one is fired with a desire to ferret out the answers to a hundred questions about this little-known relative of man—questions of increasing importance to scientists and physicians in their efforts to understand and to aid man himself."—Carl E. Akeley.)

The Park National Albert of the Belgian Congo, consisting of two hundred square miles, an area one-sixth as large as the State of Rhode Island, is located east of Lake Kivu, and north of Lake Tanganyika, the center of which is one degree south of the Equator. It comprises the three extinct volcanoes of Mikeno, Karisimbi, and Visoke. In this region, since the royal decree of King Albert of the Belgians on March 2, 1925, the gorillas have had sanctuary. By recent act of the Belgian Government, since the return of our expedition, a large area has been added to the Park National, so that it includes all the volcanoes of the Birunga Range and a big part of the Rutshuru and Ruindi Plains south of Lake Edward. Crown Prince Leopold is working further to have the three eastern volcanoes in British territory included in the Belgian Park under special statute.

To enter the Park National Albert by trail from the east, one must travel six long days on foot from the end of the motor track leading across Uganda. The boundary between the Belgian Congo and British territory is not, however, a natural barrier. It lies in the dense forests of the gorilla mountains. Whereas the larger number of gorillas supposedly live in the protected Belgian territory, there are also gorillas on the semi-protected Uganda side, on the volcanoes Sabinio, Mgahinga and Muhavura.

When Mr. Akeley in 1923 advocated to the Belgian Government the desirability of adopting the policy of protecting the gorilla, he estimated their number at not more than one hundred in the Mikeno-Karisimbi forests, and our observations in 1926 led us to the same conclusion.

At an altitude of 9,500 feet at our Rueru camp near a small water course and only a few rods distant from Mr. Akeley's old camp of 1921, we first saw gorilla trails. We found them in the upper edge of the bamboo forest, where the bamboos give place rather abruptly to the large trees and dense undergrowth of the upper reaches of the volcanoes.

THE DWELLING PLACE AND FEEDING GROUND

As the brief story I have to tell concerns the environment of the gorilla, I shall first describe this bamboo forest which the gorillas use for a part of the time as their dwelling place and feeding ground. The bamboo forest covers the steep mountain sides and for the most part is so dense that no human can travel through it without crawling on all fours or cutting out a trail. The bamboos grow compactly to a height of ten to twenty or more feet, and are topped with dense, feathery foliage. During the day the forest is enveloped in twilight, therefore, and on moonless nights the darkness is intense. Elephant, buffalo, and gorilla travel through this forest by breaking out a trail. That the gorilla can do this without suffering any physical hardship or detriment to his hairy coat is evident from the excellent condition of the skins of the gorillas Mr. Akeley collected in 1921. Apparently as he travels to and fro for his forage, he is constantly making new trails. Where the bamboos flank a native-made or animal-made trail, there is an undergrowth of nettles, tall, profusely-growing begonias with small, pink flowers, single fuchsias, white hibiscus, and many brilliant orchids. At the upper edge of the bamboo forest it is dotted at wide intervals by large trees growing to a height of one hundred feet or more.

THE GORILLA'S FOOD

When he ranges, the gorilla feeds on the succulent sprouts of the young bamboo. The young shoots, which are pinkish gray with a covering of powdery brown, have a sweetish bitter taste. The gorilla eats these tender shoots in entirety, while the less tender shoots he tears open and eats of the inner portion.

On our way up from the Rueru camp at 9,500 feet to our permanent camp at 12,500 feet on the slope of Mt. Mikeno, Mr. Akeley and I heard a band of gorillas moving slowly near the trail. A short, deep bark gave evidence that they noticed us. They had not been greatly disturbed, however, but were moving slowly, even though our safari of two hundred porters had preceded us on the trail.

Our main camp on the slope of Mt. Mikeno was in the heart of the gorilla country. It was here that Mr. Akeley had made his motion pictures of gorillas in 1921—the first ever made of live, wild gorillas. For six weeks I remained in this high camp attempting to further the work of the expedition.

My work necessitated the help of seventy natives and considerable traveling through the forest. There was the usual amount of noise attendant upon a camp of that size, yet gorillas came within three-quarters of a mile of camp and fed and slept there. My work took me

into the field a few miles from camp in varying directions, and whereas it did not give me the opportunity for the intimate study of the gorilla that Mr. Akeley and I both had anticipated so keenly, yet it did at least give me the opportunity for a long and comprehensive study of the gorillas' mountain home.

At this elevation of 12,500 feet, the gorillas' home in the Kivu forest is beautiful beyond any words to describe. Everywhere are large and ancient trees with flowing draperies of gray-beard moss, and with long trailing green parasitic vines, dotted with tiny yellow star-like flowers.

There are two dominant trees in the forest. One is a tree with very small leaves and a rose-like, yellow, single flower. It has a rough bark almost like a black oak, and grows to a height of thirty or forty feet. The natives called it Musum Gura. The botanical name is Hypericum Lanceolatum, the family Hypericaceae. The other dominant tree we called the paper bark tree. It has great clusters of leaves almost like a white walnut, and reaches a height of from forty to one hundred feet. The natives call it Mugeshi. The botanical name is Hagenia Abyssinica, Family Rosacea. In this latter tree, and for the entire length of its largest branches, are great platforms of green and golden moss out of which grow orchids that flower in tall, pink spikes. These moss platforms are often two to three feet wide and twenty to thirty feet long, extending the entire length of a massive limb, that grows almost at right angles to the main trunk of the tree.

From these mossy platforms dark green ferns from one to four feet in length hang in great fringes and flutter and sway in the passing breeze. Other thick, creeping vines grow twenty to thirty feet upward from the ground, clinging tenaciously to the tree trunks and covering and trailing from the forking branches. It is indeed fairy land. It is in the protection of these prolific vine and moss canopies or in the dense undergrowth that the gorilla nests or beds are most frequently found.

THE GORILLA SLEEPS IN A CLEAN BED

In such a location I happened on twenty-two recently occupied gorilla beds. I found their nests of various kinds. Most were at the base of vine-draped trees, where the earth was protected from rain. Here vines green or dead formed a shelter at each side of the overhanging trunk. The dry earth, with a few dried vines or a little dry moss, formed the bottom. Sometimes the beds were only slightly hollowed out; at other times, hollowed to a depth of ten or twelve inches. In three instances in this group of twenty-two nests, I found a large nest side by side with a very small one. Frequently, I saw gorilla

foot and hand prints. Under one tree I found one pair of nests aforementioned. Under another, not more than three feet away, I found another pair, almost identical. There was little evidence that either had been used a great while. Many nests were made of the lush, green herbage, fashioned in a circular form like a basket.

DROPPINGS FREE FROM PUTREFACTIVE ODOR

Many of these nests were quite clean; others contained many coarse, heavy black droppings, while similar droppings were scattered outside the nest nearby. There was no disagreeable odor to nests or to droppings. This is in great contrast to the beds and droppings of the cat family for example.

These beds are made by the occupant in the simplest way, by drawing together the vines, plants and dead twigs that happened to be within easy reach. In all, I saw more than fifty nests, old and new, and not one of them was in a tree or even slightly above the ground. Furthermore, in all of Mr. Akeley's observations in 1921, he found nothing to corroborate the statements of various visitors and hunters in the Congo that nests are occasionally built by bending over young bamboos or other branches and weaving them into a springy platform. In no case did he see such a bed.

The most unique nest I found in this group of twenty-two was built of the broad leaves of the palm-like plant which the natives call 'Muiloomba.' The nest was built in a veritable thicket of this plant. The gorillas had broken off the tops (some were easily six feet high), and the stalks were everywhere, exuding a milk-white sticky juice like that of the milk-weed and poppy. The nest was built on a slope of ground with a log about eight inches in diameter as the lower margin. The broad leaves were laid one upon another, apparently with a great deal of care and precision. This nest was the deepest I had seen, about twenty-two inches in diameter. It was quite clean. I think any one of us, accustomed to the open, would have found any one of these beds quite comfortable enough for a good night's sleep.

MAINTAINS GREAT STRENGTH ON A DIET OF WILD CELERY

This gorilla band had fed over a large area. Here the large trees grow far apart and there is an undergrowth so dense that you must cut your way through it with native knives because it is too sturdy for man to trample down readily. In this dense thicket the wild celery grows abundantly, reaching the height of eight to ten feet. It is of course the most interesting of all the plants because it is the one on which the gorilla feeds in this high altitude. As you cut or break your way through this dense undergrowth, you hear the lush vegetation crackle under your feet, as if you were walking in a field of fresh,

young rhubarb in the springtime. The stalks are so lush and filled with water that they break with a snap.

There are three varieties of wild celery, one with a very coarse leaf, a second with a medium sized leaf, and a third with a very fine delicate leaf. The first and third varieties are called by the natives "Kisengosengo," and have the same botanical name, Anthriscus Sylvestris. The second, the natives call "Kihunga Muyaga," and is known botanically as Pencedanum Kerstenii. They are all in the family Umbelliferaceae. This wild celery has certain points of likeness to our cultivated celery. The leaves are similar, although the leaves of the wild celery are far more complex. The wild celery stalk is thick, succulent and the young shoots crush or break readily. Even the odor is somewhat suggestive of our cultivated celery, although it is milder in odor and flavor. In color the stalks are pinkish green and near the roots they change to a reddish, purplish color. The plants are topped by masses of dainty white flowers.

The gorillas pull the celery up by the roots and feed on the succulent roots and lower stalks. Everywhere I saw where they had stripped the lower stalks and had apparently eaten the hearts. All around lay the dry, yellowish outer husks. In one place the gorillas had climbed up on the big, overgrown base of a half dead tree and there had crushed and trampled and eaten the dense vegetation.

After the gorillas have finished their meal, the "celery patch" looks something like a field of young corn after a herd of hungry cattle has had its fill.

It is an established fact that the gorilla travels leisurely. Three days after I inspected these twenty-two gorilla beds just mentioned, Dr. Derscheid came upon a band of about twenty gorillas three miles south of our camp and in the same direction that the gorillas I mention had taken. It may easily have been the same band. I had followed their trail for some distance, and had found that they had been feeding all along the way on trails that crossed and criss-crossed. It is quite easy to see in which direction the gorillas travel, as the vegetation is all broken down in one direction. He came upon them unawares in the midst of high vegetation. One old male was outstanding and there were several females with little ones clinging to their necks. The old male stood his ground, and, while the females and young made their escape, came out of his way to investigate Dr. Derscheid. The conclusion was that the old male felt considerable responsibility for the safety of the females and young.

During the six weeks I stayed in this high camp on the slope of Mt. Mikeno, the night temperatures frequently fell to 36° Fahrenheit, and

the day temperatures did not go above 46° Fahrenheit. Because we were up in cloud-land, we had rainfall on all but five of forty-two days. It is, therefore, understandable that the gorilla finds his thick, hairy coat a very comfortable asset.

THE STUDY OF THE GORILLA IMPORTANT TO MAN

Due to the fact that the gorilla is recognized by many as man's closest relative, the study of this ape is perhaps more interesting and more important than the study of any other animal. However, there is no other African beast that has been the center of so many fables and superstitions. The inaccessibility of the gorilla forests and the persistence of the myths of an imaginative and superstitious people are not the only obstacles, to those who would separate the truth from the fiction in our natural history literature, but there is also a tendency to tell and retell a tale that has been well told until that tale is generally believed.

For instance, about the close of the sixteenth century, Andrew Battell, an English captive of the Portuguese of Angola, established the idea that the gorilla walked erect, slept in trees and was the terror of natives. For many years subsequent to Battell's writing, other writers have insisted that the gorilla was inclined to a walking posture, that he lived in trees and was exceedingly ferocious.

The intrepid little French-American, Paul Du Chaillu, was the first white hunter to kill a gorilla. We have it on good authority that his story was twice rewritten before his editors considered that it had sufficient popular appeal. These stories have done much to perpetuate the first erroneous reports of the gorilla. That passage from his book, which at first reading is most damaging evidence against the great ape, appears as a harmless recital when all the words and phrases that apply to the hunter's state of mind are dropped out.

In spite of their fame as offensive warriors, the first gorillas surprised by Du Chaillu fled away from him into the deep forest. The hunters pursued until they were exhausted but "the alert beasts made good their escape'" and "the charge of his old male was proceeding hesitatingly, step by step," when Du Chaillu's gun interrupted it.

Mr. Akeley never accepted the accounts of the gorilla's ferocity. When he entered the Kivu Country in the fall of 1921, his prejudice was in favor of the gorilla. He based his theory upon his observations of the habits of the other apes and upon his general belief in the good temper of unmolested wild animals. He was prepared to find him a decent and amiable creature, and he was not disappointed.

We hear many extravagant accounts of the great weight of the gorilla. Some have been estimated at 450 pounds, others as high as

700, but in each of these cases the actual height and other measurements of the gorilla have been less than those of the big gorilla that Mr. Akeley collected in 1921. Here are the measurements and weights:

Height	5 ft. 7½ inches
Weight	380 pounds
Chest	62 inches
Upper Arm	18 inches
Reach	97 inches
Calf	15¾ inches

When Mr. Akeley collected his gorillas he found, in the case of both females, a strong negro odor. In the case of the male, which he reached about 15 minutes after death, there was no odor at all. Both females were accompanied by young, but not nursing young.

AN EXAMPLE OF PERFECT HEALTH

In the preparation of the skins or skeletons of the gorillas, he found not a single external or internal parasite. Dissection showed them as perfectly healthy, more so than any other animals he had ever dissected.

He found the face of the gorilla mild and gentle. It is only the conventional taxidermist who is inclined to make the most of the great teeth and the mobile features by distorting them into all sorts of horrible facial expressions.

In Mr. Akeley's study of the gorilla in 1921 and in my own and Dr. Derscheid's study in 1926, there is only one report of the gorilla's having killed a native. This story was told to Mr. Akeley, and we obtained the same story from various sources in 1926. At a native village in the hills, back of the Lulenga Mission, an old male gorilla invaded the banana grove. The chief instructed his people to drive him away without the use of spears, which were forbidden because of a superstitious reverence for the gorilla. The attempt was made to drive the gorilla away from his forage, with the result that the gorilla killed one and wounded another. The interpretation of the incident may easily be as follows:

The gorilla had wandered from his normal haunts, was very hungry and being in the midst of his meal, naturally objected to being driven away from it. This action is much as you would expect any normal creature, who was not cowardly, to do.

During the time that we were encamped on Mt. Mikeno, in 1926, Dr. Derscheid, with Mr. Akeley's old gun-boy, Bill, met a band of gorillas about two miles from our camp. As they approached, an old male held his ground long enough to look them over carefully. His expression was that of wonder and surprise. When they approached him, he moved slowly away, stopping to look back at frequent intervals

and remaining for a long time in excellent photographic range. He displayed no haste and certainly was not aggressive. They followed him for more than an hour, when he quietly rejoined his companions.

THE POWERFUL GORILLA

The vegetarian of the Kivu jungle, whose forage consists largely of succulent sprouts of young bamboo and the roots and lower stalks of wild celery. The above is one of five specimens taken by Mr. Carl Akeley in the Kivu Volcanoes of the Belgian Congo, and mounted for the American Museum of Natural History in New York City. Mr. Akeley found the gorillas entirely free from external and internal parasites, and considered them the healthiest animals he had ever dissected.

PREHISTORIC LIVING

HENRY M. AMI, D.Sc., Director Canadian School of Prehistory in France, Laboratory of Geology and Palæontology, Ottawa, Canada

This is a period of reconstruction—a period of post-war reconstruction. The Third Race Betterment Conference comes most timely, as it deals more especially with problems of reconstruction in respect to man, his characteristics, his physical, intellectual, moral and even his spiritual nature. Much of the best of the world's manhood was killed in the last great war. They who went first and foremost to the front bore the brunt of the attack on humanity. We miss them and their influence. Today, the halt, the maimed, the blind, the legless and the armless men, the great wounded, are undergoing a period of reconstruction. The world is taking stock of everything. Even the League of Nations, with a view to bringing out Peace relations amongst them, has had prepared a set of reports giving the stock of raw materials in the world, so that those nations that possess will be willing to give to the nations that have not of these materials at a reasonable figure, to the end that peace, progress and brotherhood, or cooperation amongst nations, may be effected.

A period like the present one, when the Third Race Betterment Conference takes place, marks a great step forward in respect to the reconstruction of man, where he may be described as needing it, where remedies may be applied to make him a fitter citizen of the community, of the world.

Right living, healthful living, biologic living, should mean happiness; it should spell joy to one's self and to those about us. We all inherit of our ancestors many traits and characteristics. Strains will out—good ones, and others. This Conference is most inspiring, not only in the number of most valuable papers presented, but also in the type of men that the Race Betterment Foundation has brought together in this grand symposium on the health of an all-round man.

When Doctor John Harvey Kellogg was good enough to invite me to come and take part in this meeting, I gladly acceded to his wishes, for I knew beforehand the sort of ideals which the head of the Battle Creek Sanitarium deals out to his friends and patients. I am a strong believer in the Doctor's grand ideas as laid down in the program of the Conference. He is truly a Harvey in Medicine, and what we would better do after this is circulate and propagate the good received.

As is our President, Dr. C. C. Little, we are all intensely interested in future generations. He and other speakers also have expressed their intense interest in the future, in the welfare and health of generations to come. My humble work has taken me into generations past. The studies of *"Life on this Planet"* since pre-Cambrian times on to the present, through all the stages of creation, of the orderly and continuous succession of life, studies carried on for more than forty years, have revealed to me, as to other palæontologists, laws and principles of great moment and value to human beings of this day and generation. Therefore, the obverse of Dr. Little's statement will apply to us palæontologists, for we have an intense interest in past generations. Insofar as their past can teach us lessons, it is for us to learn them.

THE LAST CHAPTER OF LIFE ON THIS PLANET

In respect to man, what do we find? The last chapter of life on this planet deals very especially with man, the acme of creation. What were the past characteristics of man? What were his industries, his activities, his beliefs, his customs? Did early man live out-of-doors more then, than now? Did he live closer to Nature? Was he a healthier creature? How did he develop to be the creature he is, the *Homo sapiens* of today? According to the Prehistorians of France, of England, of Spain, of Czecho-Slovakia, of Italy and of the Mediterranean Basin, as well as according to those of the Western World, man has lived on this planet some 450,000 years at least. Problems of all sorts arise as man, his ancestry, his lineage, his contemporaries, and his varieties in type as known today are considered in the light of evidence obtained from the earth itself. I mean to touch upon only a few of them. After listening as you have this morning to papers on sunlight in all its phases and its influences for the good of man's health, let us turn, for a moment, the light of recent research on primitive man, to ascertain, if possible, when he lived, where he lived, how he lived, what he ate, how he rested, where his activities led him.

It is to France that one must go for discoveries made that are of great value to science in respect to man. France is the great Sower of Knowledge—*La Semeuse*—as she is styled. Fossil men have formed the special study of a group of scientific men of France. "Les Hommes Fossiles," by Marcellin Boule of Paris, is the standard work on the subject of human remains found in a fossil state. The "Institute of Human Palæontology" has been established for many years in France, in Paris (1 rue Rene-Panhard). This institution, with its staff of professors and officials, devotes its whole energy and funds to the discoveries of relics of humanity in prehistoric times. It is to France,

again, that one must go for information on prehistoric man. It is in France that humanity can recognize its antiquity, for mankind has lived there, in the southwest of that country, on the southwestern slope of the massif Central of France, east of Bordeaux, for nearly half a million years. Incidentally, that may account for the fact that Frenchmen seldom emigrate and leave their lovely country, having been tied to the soil of France for such an enormous length of time. They are truly the children of the soil.

EARLIEST EVIDENCES OF MAN

Let us glance hastily at the different epochs that mark the presence of man on earth. From such a comprehensive survey, one can readily see what sort of life man led, or was forced to lead; we can see of what primitive man's life consisted, what prehistoric living meant.

The age of man on this planet covers the whole of the Quaternary Era in geology, and a little more.

It is to England, to East Anglia, and not far from the town of Ipswich in Essex, that we must go for the first evidence of man's activity in tool-making in certain Upper Tertiary strata. Mr. Reid Moir has for many years been obtaining from the Cromer district a fine series of implements indicating primitive workmanship. Prehistorians and scholars of France and of other countries have recognized the implements discovered as genuine artefacts. Ipswichian Man made tools from rough flint stones in Tertiary Times, but no remains of the skull or skeleton of his have as yet been unearthed. The Ipswichian Period of man is now an established period, antedating the Chellean Period of the base of the Quaternary, of which there are many deposits in many parts of Europe, Asia and Africa, including the Thames Valley and the Seine Valley.

THE CHELLEAN PERIOD

This period is called after the town of Chelles, just east of Paris. The accumulation of gravel beds and of earthy layers are there to be found in the Marne Valley, where occur not only rude and crude implements, tools of man's making, but also remains of elephants like those of Africa, of horses, bisons, lions, rhinoceroses, which indicate the sort of climate that prevailed at the time. This was in the beginning of the Quaternary Era, and the climate was warm and humid. Rivers were very large, and filled the valleys to the tops of the plateaux.

EARLY MAN WAS A VEGETARIAN

Fruit trees abounded at that time. Man fed on practically nothing else but vegetation. He was, in fact, a vegetarian. He was no doubt more arboreal than a pedestrian. He wore no clothing. Gigantic pachyderm were his contemporaries—inoffensive creatures of warm

regions. The ancient elephant, Merck's rhinoceroses, hippopotami, herbivorous creatures such as the ox, horse, and the deer, also lived then. There were also the great carnivores—the lion, the tiger, the hyæna, the cave-bear, etc., against which man had to struggle.

Chellean Man lived on the high plateaux east and west of Paris, in the south of France and Pyrenees also. He occupied at times the uppermost terraces that had begun to rise out of water. Man in this earliest phase of his existence had learned to cut, to fashion tools with which to make holes and others to scrape and to sharpen wooden implements. It must not be forgotten that the Wooden Age must have preceded the Stone Age, and that since the making of stone and flint implements, man has practised his arts in both these directions. At first, no doubt, he found on the ground rough pieces of flint or stone shaped by Nature for his use and employed them. Later, he fashioned his tools from a block of flint with the use of another flint or stone for a hammer. He made a sharp-pointed tool to gather his vegetables and food from the luscious plants and vegetation of the epoch. Still later, Chellean Man made *cordiform* implements, *coups-de-poing* and other shapes for his daily use. Even throughout England a warm, tropical climate obtained. Hippopotamus remains have been found in the gravels of Cambridge as plentiful as plums in a generously-made plum pudding. Tusks, ribs, and bones of this gigantic African type of creature were exposed in every direction. It was only some three years since that Hippo remains were obtained from the gravel bed in the Thames Valley, thirty-two feet below the monument, Trafalgar Square, in London. The Chellean Period was one of great precipitation of moisture.

Thus, Primitive Man was a vegetarian, by choice, by nature, by his very dentition and by his close relations to the other highest types of organized creation that were still extant, or had already (some of them) disappeared from this planet. Fruits, bananas, nuts, soft, luscious or juicy stems of plants, such as existed in the forests of the Chellean Period, were his to eat, and on them he thrived.

The only human remains of what may possibly be those of Chellean Man were discovered in Central Europe. The Mauer jaw is very simian in shape—while the teeth are human. The Java skull, or top of the skull, found in the Island of Trinil by Dubois, was more simian than human. Further researches in Java may throw light on this Far East discovery. The Chellean Period must have lasted at least 75,000 years.

THE ACHEULEAN PERIOD

This period is called after St. Acheul, a suburb of Amiens, in the Somme Valley—west of the City of Paris. During this period the warm and humid climate of Chellean times persisted. The faunas and

floras remained likewise pretty much the same, and man had practically the same habits, customs, and characteristics of the preceding time. He lived out-of-doors, and enjoyed himself eating fruits, nuts, and other examples of vegetable diet, as did his ancestors. The tools and industries that he fashioned were much like those of Chellean Man, except that they showed signs of decided improvement, of finer workmanship, exhibiting more skill, taking more pains, and turning out better tools. The law of life, the urge in every normal type to be one better, two better, is seen in the tools made by this early type of Palæolithic Man. His inventive genius is readily seen in the way he fashioned these tools to meet his daily requirements. Drills, discs, hammers, knives, blades, planes for cutting and shaping points, also piercing tools, saws, axes for chopping and others were instruments devised by himself.

FORCED TO EAT FLESH

But, about the time that the Acheulean Period was half passed, the climate began to change. Heat and cold in Western Europe and Africa changed places. The Ice Age in Europe began to invade the northern portions of that continent, and new conditions arose. But man's genius met his new conditions. No doubt some Acheuleans followed the warm and good climate, and trekked south, back to Africa, whilst others, those who loved their homes best, remained on the spot and sought rock-shelters, as the colder conditions prevailed and became more intense.

It is at this time, and before the next or Moustierian Period, that man learned to use and to control fire. He needed it. He had seen it—Nature in the lightning and forest fires had taught him the heat values of a wood fire.

Acheulean Man began to clothe himself. Man found out that skins of animals, especially fur-bearing animals, made him comfortable. By this time the climate grew colder, and more severe. He found that one after another types of vegetation to which he was accustomed had disappeared. Others took their place but of a sparse and perhaps less luscious and palatable type. There was evidently not a sufficient amount of food supply from plant life left him, and Acheulean Man was forced to eat flesh or meat cooked in the fires.

A study of the various changes of climate as revealed by the animals of the different Epochs is very illuminating and interesting. Whereas man ofttimes withstood severe climatic changes and remained on the spot where his forebears had been before him, the animals themselves that had been his contemporaries disappeared, changed in type, and were replaced by others differing in characteristics. The hairy elephant (mammoth), the woolly rhinoceros (rhinoceros-tichorhinus), covered with heavy fur, replaced the giant pachyderms of the Chellean

Period which became extinct in France. The new rhinoceros had partitions or chambers in his nostrils, as the word tichorhinus indicates, enabling it to breathe the cold air more easily.

Man went on developing his arts and industries, and must have been a very healthy individual in those early days. His dentition was excellent, perhaps far ahead of ours, but it is the exception that human remains in the form of skeletons or bones of man are preserved, and Fossil men are few in number, especially in the most ancient deposits in which remains of his tools and industries occur.

The horse, the ox, the deer still continued. Man made and utilized skin, scrapers and fashioned *coups-de-poing,* sharp-pointed and cutting tools, in fine style, with better finish and of different sizes and shapes than those of his predecessors.

THE MOUSTIERIAN PERIOD

This period is called after *Le Moustier,* a village of southwestern France in the Dordogne district, east of Bordeaux. During Moustierian times, the climate was cold and humid. It snowed more than it rained. Enormous masses of ice covered mountains, as well as the whole of northern Europe. The ox, the horse, the goat, the deer, became prey of man in his hunting expeditions. The woolly rhinoceros with cloistered nostrils still haunted the country with the hairy elephant (the Mammoth), and the reindeer began to appear, ushering in "the Reindeer Period." The flora became modified, and tundra conditions of subarctic countries obtained. Man ate of the animals that he hunted and cooked their meat. Today one finds the refuse heaps and old hearths or fire-places in the old rock shelters or habitations of man. Bears and other carnivora still lived in caves.

During this period there was a re-warming of the climate, and a withdrawal of the great ice sheet over certain areas of Europe. Moustierian Man occupied terraces along slopes, or rock shelters, and even open caves, facing the south. He fashioned tools for his daily use, such as the triangular point, with one plane surface. He utilized large bone fragments as compressors, in retouching or fashioning finer flint edges. He hunted, and painted his body with colouring materials. He buried his dead in the attitude of sleep or rest. He buried them in two ways: (1) In a hole in the ground, or grave, filled up later; (2) on the surface of the ground, covering up the remains, making a mound or tumulus. Moustierian Man must have had a religion, for in his burials he expresses his belief in the life beyond.

Human skeletons from this Moustierian Period comprise those found at Le Moustier, La Ferrassie (Peyrony), La Chapelle-aux-Saints, La Quene (Dr. Henri Martin), Spy in Belgium, etc. Several

of these have been exhumed and described by Monsieur Peyrony of Les Eyzies. The top of the cranium of Neanderthal man forms one of the discoveries of this Period.

THE AURIGNACIAN PERIOD

The Aurignacian Period was called after Aurignac in southern France. At the close of the Moustierian Period, a new race invaded the southwest of France and the center of Europe. It drove the Moustierians out. It was a tall race of a Dolichocephalic type of skull, with straight or erect brow, prominent chin, a broad and short face, erect

Aurignacian Rock Shelter of Cro-Magnon at Les Eyzies, Dordogne, where skeletons, ornaments and flint implements were obtained in 1862. Reindeer Period in full swing. Many types of tools occur here and in other adjacent sites, also at Aurignac, S. France, the type locality. (Photograph taken by H. M. Ami, 1923, at Les Eyzies. Note the phenomenon of erosion. Selected as a burial site.)

in posture. Women had wide hips, surmounted with fatty gibbosities, much like the Bushwomen of Africa, with short legs and big thighs "especially well-fitted," French prehistorians tell us, "for maternity." Man, on the other hand, was slender, fit for tramps, hunting and similar activities in the open, including perhaps fighting with wild beasts. The cold climate continued, but the air became drier. The Moustierian fauna persisted, with abundance of reindeer in this Aurignacian Period.

MAN A HUNTER AND ARTIST

Man drove wild animals from caverns and inhabited them himself, or lived at their entrance, whilst the interior and depths of the caves became his sanctuary and resort where, under the feeble light of a Palæolithic slab of rock with a depression on one side for a lamp, he painted and engraved and began to do some sculpture. Aurignacian (also called Cro-Magnon) Man tattooed his body, and adorned himself or herself with necklaces, pendants made of teeth of animals or of shells with holes made in them with piercing tools. He also worked in bone, and made fine points, and carved on ivory, bone, horn, and stone, fashioning points, polishing bone, tools, darts, making cutting implements, daggers, fish-hooks, besides heavy scrapers, simple and double ones, engraving tools, piercing tools, etc. This intelligent and artistic fellow was a sculptor and engraver on bone and stone and he used picks and gravers. He manufactured (with his hands) fine tools, making fine retouches all along their borders to strengthen them. He became a great hunter and a fisherman.

He buried his dead, especially his chiefs (as at the Cro-Magnon locality at Les Eyzies) in especially selected spots and had probably the idea of the after life, a belief in immortality, from the manner in which he buried a complete set of tools and implements around the deceased remains in the hope that he could use them in the world beyond. The lower, the middle, and the upper Aurignacian deposits of France are characterized by special types of tools and industries respectively.

Of human remains discovered are those of the Cro-Magnon rock-shelter at Les Eyzies, those of near Lyons, eastern France, and that of Combe-Capelle, also that of Grinaldi (near Mentone, France) in Italy.

THE SOLUTRIAN PERIOD

Climatic conditions continued cold. Man inhabited rock-shelters and caves, and adorned them. But little progress in artistic designs was seen, from evidence gathered in many localities of southwestern and of eastern France (*Solutré, near Macon*). He tattooed his body and adorned the same. He invented the needle to sew his clothing. He abandoned bone tools and made an amazing advance in fashioning tools in flint, some of most exquisite workmanship. He lead in the flint industry. Laurel-leaf pattern tools, and other beautifully wrought slender flints occupied his marked attention. Solutrian Man had a rite or cult for the dead. He adorned them in burial.

At Solutré near Macon, south of Lyons, eastern France, also at Brunn in Austria, etc., skeletons of human beings were discovered in old habitations of the Solutrian Period. There are three distinct phases of Solutrian deposits in France yielding remains, and even a fourth, Probo-Solutrian.

THE MAGDALENIAN PERIOD

The Magdalenian Period derives its name from the rock-shelter or Abri of La Madeleine, near Les Eyzies, in the Dordogne district of France, east of Bordeaux. It is an artistic period *par excellence.* Cold increased. Reindeer were very abundant. There was an advance of the ice sheet from the north, and the climate of southwestern France and of the Pyrenees country became like that of Lapland, with a very similar fauna and flora. Antelopes, goats, chamois, polar bears, the

Magdalenian Rock Shelter, Abri du Château, Les Eyzies de Tayac, Dordogne, France. These rock shelters were carved out of Cretaceous limestones in Tertiary Times, and man occupied them in Palaeolithic and Neolithic Ages of Prehistory in the Bronze Age, in the Gallo-Roman Period, also in Mediæval and Modern Times as well.

(Photograph taken by H. M. Ami in 1923 at the Château—now the Museum of Prehistory.)

lemming and the marmot abounded and were contemporaries of the mammoth (hairy elephant), the woolly rhinoceros (rhinoceros-tichorhinus), with the ox, the horse, and the deer still extant. The large carnivora had disappeared.

Man was essentially a troglodyte, inhabiting rock shelters and caves. He carved on bone, ivory and horn; he made bone needles in fine fashion, he also made daggers, harpoons with single and with double rows of barbs, fishing hooks, darts, and various kinds of implements in which he displayed much art and style together with artistic effect.

Flint implements, long blades and knives with or without handles, engraving tools and others, fine and delicate, in innumerable quantity abounded.

ENGRAVING

Home art, and wall or ceiling arts, as galleries, where paintings in one or more colours, engravings and sculpture may be seen to be characteristic of this Magdalenian Period as at Fort-de-Gaumme, Combarelles, La Mouthe, etc, near Les Eyzies, in Dordogne, France. The first handwriting dates perhaps from this period. Some design oft repeated becoming a symbol for some idea, some thought, some thing. Laugerie Haute, Laugerie Basse, Abri du Cap Blanc, La Madeleine, La Grotte de Raymonden, are some of the localities where skeletons of human remains were found to be of Magdalenian Age.

THE AZILIAN PERIOD

This Azilian Period is called after "Le Mas I'Azil, a village in southern France where that phase of man's industry has been studied to greater advantage. During this period the climate warmed up again, but was humid. Great glaciers, the cold, and the ice cap disappeared from the mountains and from northern Europe. The north of Europe became habitable. There was a great movement of peoples. Man had become a flock-raising individual, he ranched. Whilst the cold climate faunas pressed northward, he remained in the south of France, with the horse, the ox, the deer, the wild boar and other animals. The flora of today are practically the flora that came into being in Azilian times, and covered Europe as a mantle of verdure for beast and man.

Tools and implements in stone of peculiar geometric figures were invented by the Azilians. Flat harpoons in bone with comparatively few barbs, painting on small slabs or pebbles chosen for the purpose, more like a sort of writing than art, characterized Azilian civilization. Their industries seemed to indicate a somewhat decadent stage or element, compared with those of former days. They had a cult of the dead, and adorned their bodies as of old. The Azilians appear to have migrated from the South.

THE TARDENOISIAN PERIOD

This period is so-called from Fer-en-Tardenois (Indre), in France. It was marked by an invasion of tribes from the Italian Peninsula, who came probably, originally, from Africa, like the Azilians, who on the other hand entered Europe by way of the Iberian Peninsula of Spain. The Tardenoisians lived on high plateaux, and extended their conquests over most of western, central and northern Europe. Their flint or stone industry contained implements or tools with geometric (triangular rhomboids, parallelogrammes, etc.) figures and contours, implements in

bone and horn having apparently disappeared. These geometric pieces may have been small sharp blades attached to wooden shafts to be used as harpoons or other projecting implements. This Tardenoisian Period closes the Palæolithic Period of Man, to be followed by two periods of the New Stone Age or Neolithic Period of writers in Prehistory.

THE NEW STONE AGE (NEOLITHIC) CAMPIGNIAN PERIOD

This period is named after Campigne, another locality in France, where men of science have ferreted out the implements that formed the base of the Neolithic Period, which marked the ushering in of the New Stone Age, the Age of the Unpolished Axe.

At this time Europe was invaded by a new race from the East, supplying a new civilization. The skeletons obtained at Grenelle (suburb of Paris, France) or at Furfooz are good examples of the types of men of this period. The Campignians were short in stature, robust, and were brachycephalous or square-headed. They mingled with the Cro-Magnons or Antochthones of Europe, the Aurignacians, and imposed their civilization on them. The first brachychephalic and Campignian types to reach the Baltic Sea found it difficult to eke out an existence there, under the distressing climatic conditions still persisting. Their kitchen-middens, or heaps of kitchen debris with shells, bones, tools and rubbish from their habitations, give us an idea of their food in that north country. Only the harder parts of shells or of animals are preserved, whilst the plants, beans, peas, grain, and other vegetable foods could not similarly be preserved there nor in any of the preceding periods.

The Campignians were the first to domesticate the dog. They fashioned and used the hatchet (a stone axe), the pick, and made deer-horn combs. They were amongst the first to make pottery from clay, though feeble examples of baked clay are found at earlier stages in Prehistory.

THE ROBENHAUSIAN PERIOD

The Robenhausian Period of man is the last stage in the history of prehistoric man appertaining to the New Stone Age; the age of the Polished Axe. It derives its name from Robenhaus in Switzerland, where this phase of life has been studied to advantage. This is the only period, along with the Ipswichian, that is not French. This Robenhausian Period is marked by the complete disappearance of Palæolithic civilization. The dolichocephalic and brachycephalic races of Europe mingled. Hunting and fishing did not suffice, and were supplanted, if not complemented, by agricultural and ranching pursuits. Primitive man of the Robenhausian Period domesticated the ox, the horse, the pig, and other animals. He became a farmer, an agricul-

turist. He lived in communities, in homes built over lakes. He was the "Lake Dweller" of Scotland, of Switzerland, of northern Italy, and made rapid strides in civilization.

TRADE AND COMMERCE

Man, in this period, carried on commercial relations, importing or exporting materials in the raw state to make implements or to advance his arts and industries. The Robenhausians exchanged their products by land and by water. The nature of their crafts is well-known, as many interesting relics have been brought out of lakes, or been gathered systematically and carefully by Prehistorians of Switzerland such as Pittard and others. The treasures found reveal very advanced methods of doing things. Robenhausians learned to weave, and to make clothing of both vegetable and animal fiber or of hair. They polished long and short axes of flint of various kinds of hard rock including granite, greenstone, and other crystalline types, using large field stones as polishing materials, chiefly grits or sandstones, many of which may still be seen today in forests or in open spaces in the country or in museums, where they have been deposited. They also had a cult for the dead.

To this, the last period in Neolithic times, belongs the great monuments erected by men of this age, such as Menhirs, Kromlechs, and similar megaliths or tumuli which evidently pertained to some cult or religious ceremony, during their life-time.

It was in this period, likewise, that man began to grind his corn, or whole wheat and cereals, and bake them, so as to produce tasty morsels, and food of value and of significance for the good of his dentition.

The foregoing epitome of the different periods of early man's existence gives in a very brief outline some of the salient characteristics of the human race in ages past.

RACE BETTERMENT

If by Race Betterment the human race is meant or understood, I take it that all the races that are comprised in the human family must go on developing and becoming better and better, according to the great underlying laws and principles of all life on this planet, the law of going *one* better, *two* better, etc. Each race must work out its own salvation on this planet. Nevertheless, as *Homo sapiens* sees himself, including all the representatives of this species as at present known, it is a significant fact, that, for the betterment of the whole human race, the various groups or units or aggregations of the five great, natural divisions into which man has been divided, must cooperate and coordinate forces, to the end that a real betterment may follow; that this world,

on account of the better understanding, not only among the various races of mankind, but among the various nations that mark the subdivisions of races on earth, must also become a happier, better and pleasanter world to live in.

VARIETIES OF RACES

The five races of mankind on earth are these:

1. The Polynesian or Malay Race.
2. The African Race.
3. The Mongolian Race.
4. The Caucasian Race.
5. The American Race.

All these races have gone on advancing, progressing, prospering under great diversity of climate, and topographic features on earth. They have, many of them, undergone trials and tribulations, vicissitudes very similar to those that mother-earth herself has gone through in her ages past, and the influences of the features of mother-earth on the many races, tribes, communities and individuals are most marked. *Homo sapiens,* in all his varietal forms and colours, is a unit. All these forms are of marvelous type, and all are enormously high in the scale of creation—in the long line of the organized types of life on this planet.

The populations of Asia are most Mongolian and those of the Pacific Islands Polynesian. Europe and America are chiefly inhabited by Caucasians, a race that originally came from the Caucasus in that beautiful region of Georgia whose capital is Tiflis. What a large number of nations are today drawing a line around themselves and are glancing at one another in astonishment, at times in fear, at other times in suppliant fashion, to know what one or other is to do next. If races vary materially, can we not find one of the main reasons for this in the speed in which they develop, or in the lack of speed?

That all races on earth, and that all nations likewise, have not yet reached an equal degree of development, of culture, of civilization, of genial disposition, of helpful service to one another or to all creation, is also perhaps due to the fact that each one takes its own time to work out its salvation, or that each one is hindered rather than helped in the great lines of progress, prosperity, and of peace. Both by external and internal troubles development is retarded. Looking around, we think that we see races, nations, individuals that have not yet learned what it is to control themselves. When we look about us, again, we seem to see those nations which are controlled by the forces of Nature about them, whole peoples who, in areas of mountainous type and topography, are influenced by their surroundings, by the torrents

that tear down the slopes of their mountains, and other trials pertaining to the same phenomena. They know not what strikes them, what hinders them in the very day of life; they know not what is going on about them. When these nations of the world that are today controlled by the forces of Nature will have learned to make use of those forces, will have learned to appreciate them, will have harnessed them and made them subservient to their will, the individuals who make up those nations will have learned the lesson of life, namely, how to control themselves. First let us control the forces of Nature, then we shall know how to control ourselves.

UNITY OF HUMAN RACE

God has made of one blood all the nations of the world that they may live in peace and amity together on this planet. And all creation is tied together, just as every man, every individual is a boiled-down epitome or résume of his whole by-gone ancestry. Every one of us here in this Conference has in his lifetime gone through all the stages of his predecessors from early pre-Cambrian times on through all the geological ages of the world's history to the present time.

To *pull together* means Race Betterment, and to take a keen interest in the progress of every race and nation, whether backward or forward in the great chain of life, will spell a happier existence for ourselves and our times. There can be no prosperity or peace on this planet until there be a betterment of races, a betterment of nations. Then, and only then, will there be a betterment of the world we live in and of its individuals. All mankind is related and inter-related. If man, every man, could visualize his whole ancestry, what a lesson it would teach him. And just as we are all tied together, let us pull together, let us see to it that nations and races act in the Spirit of Life and of Love, which demands of every normal creature to improve, "to go one better," to be neighborly.

WONDERS OF CREATION

This is a marvelous world or earth we live in. By nature it is wonderful, and its beauties and joys can never be exhausted. The vastness of the domain of mother-earth as it spins through space is so great that it encloses a great circular eclipse 3,000,000,000 miles long and 2,000,000,000 miles wide. The great Universe in which we live is ours, all the Universes are ours to have, to see, to explore, to survey, to study. And what grand lessons for the average one of us, trying in his humblest way to search some of the problems that it is man's duty and privilege to investigate. If one doubts, then "investigate." "Prove all things," we are wisely told. But we are also informed of this: "Hold fast that which is true." Three thousand years ago King David made

the statement: "How marvelous are Thy works, O God! in wisdom Thou hast made them all." With what greater emphasis can we say, we who live in this twentieth century, who have museums and collections illustrating the marvels of creation, those exhibiting myriads of extinct types of life as well as those of today, that we are all tied together. How very, very marvelous are Thy works, O God! truly, in great wisdom, Thou has made them all. Thy power and Thy greatness continue ever upon the sons of men.

THE RELATION OF INTESTINAL BACTERIA TO HUMAN WELFARE

Dr. Arthur Isaac Kendall, Professor of Research Bacteriology, Northwestern University School of Medicine

A normal adult, enjoying a normal, mixed diet excretes daily from his alimentary canal a mass of bacteria that is conservatively estimated to number some thirty million of millions. This goes on continuously day after day and month after month. One marvels at the perfection of that alimentary incubator and cultural medium which permits of such a remarkable output of microbes with so little tangible evidence to the possessor thereof. Indeed, not one person in a thousand has even heard that the bulk of the daily fecal mass weighing some three ounces is composed largely of the bodies of bacteria, each separate one of which is scarcely one twenty-five thousandth of an inch in diameter.

The question has often been asked, Are these bacteria that grow so abundantly and so rapidly in the alimentary canal useful, or are they indifferent, or are they harmful? The answer is not so easily given although much effort has been expended in studying the problem. Thus, it is stated by competent authorities that the alimentary canals of polar animals—bears, for example—are much less populated with bacteria than are the bears of temperate climates. Nevertheless it seems to be quite certain that the alimentary canals of polar bears brought to captivity in warmer countries soon become as densely inhabited by microbes as those of indigenous bears, and no definite sign or symptom has thus far been detected which would suggest that the acquisition of these multitudes of intestinal bacteria has caused them either harm or discomfort.

ATTEMPTS TO REAR STERILE ANIMALS

Attempts have been made to raise sterile germ-free chicks, hatched from germ-free eggs. Aside from the very great difficulty in finding eggs that were free from bacteria (for less than three per cent of eggs are sterile within the shell), no very definite results have accrued, because the chicks do not thrive very well in the highly artificial environment that is entailed by complete sterility of food, air, water and habitat. These experiments were performed, however, before the highly interesting food accessory substances, vitamins, were well known, and it may be that a lack of these essential factors was responsible for the poor condition of the chicks after some fourteen days of germ-free existence. In any event, control chicks, kept under normal, every-day conditions, did much better for a corresponding period of

time. Also, the sterile chicks rather quickly became normal when they were placed in their usual germ-infested environment.

Experiments upon guinea pigs, delivered by Caesarian section, were equally inconclusive. The tangible results of these attempts to rear sterile animals seem to be, first, that such delicately nurtured specimens are not to be compared with those reared under natural conditions, and second, that, after all, bacteria are unavoidable natural messmates of living things and the best that can be hoped for at present is to reduce to a minimum the hazards from the disease-producing kind.

Another line of approach to the problem of the significance of intestinal bacteria is through the study of the microbic population of the alimentary tract from immediately after birth to adult age.

NATURE'S BACTERIOLOGICAL SEEDING OF THE INTESTINAL TRACT

At birth, as might confidently be expected, there are no bacteria in the alimentary tract. Within a few hours, however, the first organisms make their appearance and from that time until death they are present continually and in vast numbers.

To digress for a moment. It may well be asked, Why does not one sterilize the intestinal tract, and thus get rid of this horde of microbes? The answer is that any germicide thus far known would be toxic enough to kill the patient long before the micro-organisms could be significantly reduced in numbers. Also starvation will not eliminate them. A man who refrained from all food for 30 days still had hundreds of millions of bacteria in his intestinal tract. It is very obvious that reformation rather than annihilation must be the method of approach to the control of the alimentary bacteria.

To return to the story. The first organisms that appear within the alimentary canal of the newly born are adventitious germs that are found in the environment of the child. In unclean surroundings the kind and numbers are much more numerous than in clean surroundings. This at first sight might appear to be most prejudicial to the babe unfortunate enough to be born to poverty and filth. In spite of environmental microbic handicaps, however, Mother Nature has reared babies from prehistoric times with, on the whole, unequivocal success. The abrupt change, microbially speaking, that occurs in the normal nursling's alimentary canal as soon as the breast milk flows freely and is ingested normally, gives the clue to the reason for this apparent miracle.

Seventy-two hours after birth, or thereabouts, the bacteria that may be found within the intestinal tract of the healthy breast-fed infant increase greatly in numbers and become restricted to about three principal kinds. This is quite the reverse, it will be seen, of the condition

that prevails for a day or two after the new born makes its bow to the world. Then the numbers of bacteria are rather small, and the kinds are, or may be, rather numerous. These new bacteria, which appear so abruptly, and increase so rapidly, are furthermore of the same sort whether the babe be born in Australia or in Russia. They have a name, Bacillus bifidus, which has been conferred upon them because they grow with bificated ends in culture tubes outside the body. In this respect they are quite unique among bacteria, and this is of great help in identifying them.

Also, and this is very important, they are strong lactic acid producers. The comparatively few other bacteria that occur naturally in the infantile alimentary tract at this period of life are also lactic acid producers. It is this lactic acid, produced by the fermentation of the sugar lactose in breast milk, that is so important in the first weeks of life, shielding the immature intestinal tract of the young child from the activities of predatory microbes that may, and undoubtedly do, gain access there. It is a fact long known to physicians that normal breast-fed babies are singularly free from typhoid, dysentery and cholera. These deadly diseases may rage in a community, taking their toll of life, but the normal nursling, provided it is exclusively breast fed, enjoys striking immunity. No inconsiderable part of this apparent resistance to infection with filth bacteria of the kinds just mentioned is attributable to the fact that the lactic acid engendered by the active development of Bacillus bifidus and its associated organisms creates conditions within the alimentary canal that are unfavorable to the growth and even the survival of the typhoid, dysentery or cholera microbes. They neither gain a foothold, nor do they grow in the normal nursling alimentary canal. Herein lies the secret of Mother Nature's remarkable success in bringing the tender defenseless infant through a most trying and critical period of its existence. The natural seeding of the intestinal tract, that most favorable culture medium for bacterial growth, with Bacillus bifidus, a microbe harmless for the host but antagonistic to predatory bacteria, is one of Nature's masterpieces. It would appear that Mother Nature was a wonderfully clever bacteriologist ages before mankind even dreamed that microbes existed.

BACTERIOLOGICAL CHANGES CAUSED BY ADULT FOOD

A time comes when the mother is no longer able to provide the nutriment requisite to the needs of the growing child, and resort is had to food from new sources. This food differs in two distinct ways from the breast milk; first, it is not sterile as a rule, and second, it departs from the maternal pabulum in its relative proportions of carbohydrate, protein, fats and salts. If the new food is carefully prepared and

handled, the microbic menace is not great. On the other hand, the change in composition of this new food brings new complications that must be met, and surmounted.

The outstanding change from the microbic standpoint is the altered proportion of protein to carbohydrate. In breast milk the ratio of protein to carbohydrate is about 1:4. In artificial feeding, this ratio frequently changes to less than two parts of carbohydrate for one of protein. At first sight this might seem a trifling variation, and, in so far as it affects the well-being of the young child, it frequently makes little discernible change in the visible picture. The bacteria of the intestinal tract are, however, very responsive to dietary change, and the general reaction of the normal intestinal bacterial flora to a dietary substitution such as that suggested here is unmistakable. The dominant lactic acid producing Bacillus bifidus tends to disappear, and more versatile bacteria take its place.

In explanation of this statement, it should be pointed out that the principal reason for the prominence and dominance of Bacillus bifidus in the normal nursling intestinal tract is the ever present lactose, which permeates the alimentary tube from the duodenum practically to its lower end. There are some additional facts about lactose, which cannot be entered into here.

With the advent of artificial feeding, other carbohydrates are substituted for lactose. Also, the amount of total carbohydrate is proportionally and relatively lowered, while the protein is raised. The net result is that carbohydrate is much reduced in the lower levels of the intestinal tract, and for several reasons it may be, and usually is, absent entirely therein for a part at least of each 24 hours. Under these conditions, it is quite clear that bacteria dependent upon a continuous supply of carbohydrate for their nutrition will find conditions periodically unfavorable, and inasmuch as millions are developing each hour, the general effect of the change in diet with restriction of carbohydrate will be distinctly adverse to the perpetuation of Bacillus bifidus; it tends to disappear.

At the same time the remarkable nutritive conditions prevailing in the intestinal tract offer opportunity for development of more adaptable bacteria, and one kind in particular. Bacillus coli seems to be peculiarly congenial to the new conditions. It is not without significance that this new organism, the colon bacillus, is very widely distributed in the alimentary tracts of adolescent mammals as well as man. This might be expected if the general conditions of foods, temperature and intestinal environment were similar in this great group of animals.

The colon bacillus, more adaptable and more versatile than Bacillus bifidus, can therefore accommodate itself equally readily to the carbohydrate or to the protein residuum that is found in the lower portions of the alimentary canal under the new dietary régime. Partly because of this plasticity, the colon bacillus thrives and becomes the most prominent organism of the large intestine during normal adolescence.

Unlike Bacillus bifidus, it produces rather less acidity from its action upon carbohydrates, and in intercarbohydrate periods it produces no acid; it produces indol and other products of protein putrefaction instead. It is obvious, therefore, that Bacillus coli does not completely take the place of Bacillus bifidus as a microbic protector against alien bacteria, including dysentery and cholera. This is rather well borne out by the infrequence of dysentery or cholera in babies that are nourished entirely at the breast, and by the rather marked susceptibility of artificially fed young children to these diseases, especially dysentery.

THE FOOD REQUIREMENTS OF BACTERIA

There is another aspect to this highly significant adaptability of colon bacilli, and of many other bacteria as well, to alterations in diet. Bacteria in general require some protein in their dietary to meet their structural requirements, because bacteria, like all other known living things, are nitrogenous organisms. Life on this planet is built around nitrogen as a corner stone. The amount of nitrogen required for structural purposes, however, is comparatively little: sixteen thousand million colon bacilli would weigh scarcely one milligram, and fully 85 per cent of this mass of bacterial cells is water. Less than 7 per cent of their dry weight is nitrogen, hence small amounts of suitable nitrogenous substances suffice to provide the requisite material from which microbes fabricate their substance.

The energy requirements of bacteria, on the contrary, are large, relatively speaking—many hundred times the structural requirement. Also, and this is important, the energy-furnishing moiety of food for bacteria is non-nitrogenous. If nitrogenous substances alone are available for energy, the nitrogen must be eliminated first, as waste. Carbohydrates, on the other hand, particularly the simpler sugars, are excellent sources of energy, and bacteria will utilize available carbohydrates in preference to proteins for their energy needs, provided a choice is offered. They are quite human in this respect; a young boy will usually choose candy in preference to beefsteak.

BACTERIAL DR. JEKYLLS AND MR. HYDES

The waste products resulting from the two classes of foods that are utilized for energy by bacteria, proteins and carbohydrates respectively, are widely different. A few illustrations will make this clear.

The diphtheria bacillus cultivated in a broth medium from which sugar is excluded produces a powerful, soluble poison, which, when freed from all bacteria, still causes the essential symptoms of diphtheria when it is injected into guinea pigs. As little as 0.05 cubic centimeters of such medium frequently contains enough of the poison to kill the animal. If some glucose is added to the broth medium before the diphtheria bacillus is allowed to grow, the result is wholly different. Not only is there no poison detectable in the culture, but now it actually contains lactic acid. This is the essential constituent of buttermilk. The colon bacillus, described above, produces a foul-smelling substance, indol, when it is cultivated in the sugar-free broth medium in which, it will be recalled, the diphtheria bacillus forms its toxin. The addition of some glucose to the broth medium before the colon bacillus is allowed to grow, changes, however, the growth products in an equally striking manner. Lactic acid is now produced in the sugar broth, whereas indol was obtained from the corresponding medium from which sugar was excluded.

A large number of similar experiments could be cited, in each of which a particular microbe has been shown to produce some poisonous or disagreeable or otherwise distinctive substance in the broth cultures, and in which, in almost every instance, the addition of glucose or some other simple sugar to the broth medium prior to the growth of the bacteria reforms the microbe, as it were, and causes it, as the result of its utilization of glucose for energy in place of the nitrogenous constituents, to produce the chemical equivalent of buttermilk-lactic acid. "The sugar spares the nitrogenous constituents of the broth medium," in the language of the physiologist. It will be seen from these experiments that many bacteria are in reality Dr. Jekylls and Mr. Hydes, a startling confirmation of the Robert Louis Stevenson story in microbic life.

A word of caution must be injected here, however. It is not to be inferred that the cure for all human ills is to feed sugar. Far from it. Returning for a moment to the conditions in the alimentary canal of the normal nursling, it will be recalled that during the period of full breast milk feeding, the sugar of the breast milk is present throughout the entire alimentary canal, and continuously. Under these conditions the bacteria that are found normally are lactic acid producers. This acid is sufficiently abundant and potent to make conditions throughout the intestinal tract unsuited for predatory microbes, which are not able usually to develop in the presence of this acid environment, even though the other nutritive substances be suitable to sustain these alien bacteria. The lactic acid, in other words, is a potent barrier, protecting the imma-

ture intestines against the onslaught of alien invading micro-organisms. Also, and this is suggestive, even if small numbers of disease producing bacteria should by mischance gain access to the intestinal tract, they too would become lactic acid producing microbes as long as there is sugar present that could be utilized for their energy needs. Time does not permit of a more adequate discussion of the Dr. Jekyll and Mr. Hyde of bacteriology and its relation to the microbes of the intestines. Sufficient has been said, however, to suggest the importance of the proper kinds of bacteria in the intestinal tract of the young child.

It has been suggested that Mother Nature practised bacteriology in a very efficient and effective manner before man emerged as a biological species from his mammalian ancestry. Scarcely a day passes even now that does not reveal additional evidence of the wonderful versatility and comprehensiveness of natural processes. But mankind, even from the dawn of historic times, also has employed bacteria in a very practical manner.

WHAT THE "MILLET SEED OF THE PROPHET" DID BACTERIALLY

The nomad of the desert, from the time of Abraham, has been dependent to a large degree upon the offerings of his flocks and herds for his sustenance. In the hot, arid lands where he wanders, food undergoes decomposition rapidly, and no ice man is available to sell him relief for a price. Among the essential marital armamentaria of the nomad is a lump of casein—milk curds—wrapped in a dirty rag to prevent its drying. This lump of casein is cast into the skin which contains his freely drawn milk, and allowed to remain there until the fluid sours. Then the casein ball, rejuvenated somewhat in the process, is returned to its shroud and the nomad knows that his soured milk will not rot, nor putrefy; in this soured condition it retains its food value until it is used up.

The pious Mohammedan who uses this casein ball senses that it has caused a miracle to take place in his milk, and he gratefully—and how appropriately—calls his casein ball the Millet Seed of the Prophet. What he has actually done, as we know now, is to seed his freshly drawn milk with the active lactic acid bacteria that are carried along in the lump of casein. They are an insurance policy, guaranteeing that his soured milk shall not support the growth of putrefactive microbes and thereby become unfit for food—quite similar in essential details it would seem to the seeding of the nursling intestinal tract with Bacillus bifidus.

It remained for a great scientist, Metchnikoff, to study this remarkable phenomenon. Metchnikoff became convinced that premature senility in man is frequently associated with putrefactive changes induced

in the intestinal tract by putrefactive bacteria. It was brought to his attention that the Bulgarian peasants enjoyed, or did enjoy, long life. Upon investigation he found that soured milk was an important item in their diet. To make a long story a short one, he obtained a microbe, which he called Bacillus bulgaricus, from the casein balls the Bulgarians used to induce souring in the freshly drawn milk of their herds, and found it would indeed induce souring in milk, and very rapidly. He tried to implant this Bulgarian bacillus in the intestinal tract of man, and thereby to induce lactic acid formation, thus eventually to crowd out the malignant microbes that may be causing putrefaction. The experiment was not successful. We now know why it was unsuccessful.

The Bulgarian bacillus is a milk parasite. It has been passed from the nomadic milk pail to the casein ball, and back again for countless generations, but it has never had a chance to accommodate itself to the actual conditions within the intestinal tract of man, where it was supposed to grow. The Bulgarian bacillus, in other words, was trained to the conditions of the milk pail, but not the conditions within the intestinal tract. Many bacteria produce lactic acid, but relatively few grow well in the alimentary canal.

THE CORRECT USE OF BACTERIAL LACTIC ACID THERAPY

There is a microbe, however, in fact there are several microbes that will and do grow in the intestinal tract, producing lactic acid there *provided the diet of the person is correctly adjusted to support the growth of the organisms.* It is to these bacteria that science is gradually turning to bring about the desired result. One of these has already been discussed, namely Bacillus bifidus. This organism appears spontaneously in the intestinal tract of the normal nursling about the third day of life. It is an organism that has populated the alimentary tracts of normal breast-fed babies since, and probably long before, the Bulgarian bacillus was introduced to the nomadic milk pail. Substituting Bacillus bifidus for Bacillus acidophilus, which is in many ways more convenient than Bacillus bifidus to handle on a large scale, Metchnikoff's dream of supplanting malignant microbes in the alimentary canal is gradually coming true; and even though this brilliant scientist failed in one essential detail of his experiment, his remarkable insight is not dimmed thereby.

Curiously enough, scientists are even now falling into the same difficulty that Metchnikoff encountered. They have failed to realize that both Bacillus bifidus and Bacillus acidophilus, cultivated outside the body on artificial media, lose their original ability to cope with the conditions within the alimentary canal, and thereby become as ineffective as the Bulgarian bacillus for intestinal implantation. One does

not train for football by a correspondence course, and bacteria that are kept in the quiet, hot house condition of pure cultures upon artificial media, outside the body, in the laboratory, lose sooner or later their ability to grow in, and to dominate, the intestinal environment. It is essential that bacteria designed for intestinal implantation be obtained from the intestine itself at suitable intervals.

This subject of intestinal bacteriology, and all the complications that are of necessity associated with it, is still a very young one. Scarcely a beginning has been made in unfolding its many aspects. Nevertheless, some real progress has been made.

EVIDENCE THAT LACTIC ACID THERAPY REDUCES DISEASE IN GENERAL

One of the mysterious benefits that has accrued from the elimination of harmful intestinal bacteria has come from an entirely unexpected source. It has been found, for example, that the elimination of bacteria that cause intestinal disturbances from the life of a community not only reduced microbic intestinal disease, as might confidently be expected, but also it seemed to reduce somewhat the incidence and severity of illness in general. This has been shown very well in the death rates of cities that periodically in the past were visited by typhoid, carried in drinking water. The installation of suitable filters not only reduced the typhoid death rate, which is to be expected, but it also reduced the general death rate to a degree not predictable by the removal of typhoid germs alone. The impression is gaining ground that the correct use of bacterial lactic acid therapy for the alimentary tract reduces to a degree the morbidity and mortality due to general microbic disease. It must not be inferred that this is a well substantiated phenomenon as yet, but the evidence is on the whole promising.

THE MODERN DISTURBANCE OF THE MAN-MICROBE BALANCE MUST BE COUNTERACTED

Acute microbic disease in general (apart from pandemic disease, as epidemic influenza, which thus far has eluded the best efforts of science), has distinctly been restrained in its severity, and restricted in its distribution, as a direct result of the remarkable development of the last quarter century in bacteriology and sanitation. No small part of this remarkable achievement is directly associated with the bacteriologic control of food, water and milk. In large centers, at least, the water is chlorinated, the milk is pasteurized and no inconsiderable part of the food is sterilized; at least it is largely freed from microbes. This is a striking contrast to the conditions that prevailed when the generation that is now passing was in its youth. It is really a miracle, and of greater significance to the human race than most of the events since

historic times. We accept this miracle as an accomplished fact, and very properly, but perhaps we may overlook some of the possible effects that are of lesser significance.

Man for countless generations has developed in the closest relationship with his inevitable microbic messmates. Now, suddenly, the bacteria of lesser resistance to disinfecting agents—heat, chemicals, ultra-violet light—are abruptly eliminated from his food. The bacteria thus eliminated include the majority, if indeed not practically all, of the normal lactic-acid producing kinds. The more resistant organisms, however, many of them spore formers, and therefore difficult to kill, are still poured into the intestinal tract, as before. The important fact to visualize is that these hardy microbes are freed to no slight degree from the competition of the normal lactic acid bacteria, that were formerly more numerous within the alimentary canal and there restrained their development. Among these more resistant types are the gas bacillus, putrefactive organisms, and many of unknown potentialities. As a result of this disturbance in the alimentary canal of the man-microbe balance, new adjustments will undoubtedly take place, with ultimate effects that cannot be foreseen.

Physiologically, therefore, the perfectly pasteurized man is a new development in the history of the human race. This is not to be construed as a polemic against pasteurization, however. Pasteurization, generally speaking, has been of untold benefit to humanity. On the other hand, man-microbe balances, which have been in operation for untold ages, cannot be brusquely upset without leaving some evidence of their passing.

Mother Nature will still probably see to it that Bacillus bifidus will appear in the immature, nearly defenseless alimentary tract of the nursling about the third day of life, and continue to thrive there as long as the mother can supply the dietary needs of the infant. When man takes over the feeding of the child, and, with his present unintelligent microbiphobia unwittingly encourages abnormal intestinal implantation with undesirable microbes, a new chapter begins, the outcome of which is still to be revealed. The most important factor after all is, however, that when such conditions are recognized, they can and will be corrected.

INTESTINAL FLORA AND LONGEVITY

Dr. E. Wollman, Chief of Laboratories, Pasteur Institute, Paris.

To write on the subject of the relation of intestinal flora to longevity is in fact to evoke one of the most beautiful and original chapters in Metchnikoff's great work. It is, for me, a pleasure to realize, in a small measure, some of the ideas of my beloved and revered Master.

Metchnikoff had an unshaken faith in the beneficial power of science, and felt that the time had come to appeal to it to alleviate the ills and infirmities of old age, as science has already done in so many other directions.

According to Metchnikoff, old age, as we know it in man and mammals, is not the normal end of a normal existence. In addition to "natural" old age, there are superimposed pathological processes, the most characteristic and important being sclerosis. These sclerotic lesions are frequently the basis of numerous senile affections that cause the many miseries of old age.

Sclerotic lesions are also frequently found in intoxications, such as chronic alcoholism; also in certain types of infections, such as syphilis. In any case, there is a decided weakening of the natural cellular tissues by poisons or toxic microbes, following which the natural elements become the prey of these unnatural elements. Study of senile lesions, and phenomena such as whitening hair, show that it is a question of similar processes due to exaggerated activity of microbes.

Guided by this analogy, Metchnikoff asked himself what could be the cause of weakening with age of the differentiated cellular tissues. The constancy of these sclerotic lesions permits the elimination of contingent factors, such as acute or chronic illness, and various known intoxications. It is evident that this process is formed within the organism itself. Metchnikoff localizes it in the large intestine, the hot bed of fermentation and putrefaction. It would thus appear that it is the toxic substances, assisted by the microscopic flora, that are responsible for sclerosis and senile atrophy.

RELATION OF LARGE INTESTINE TO LONGEVITY

Discovery of this hypothesis is most remarkable; there is a decided relation between the development of the large intestine and longevity. The larger and more developed the intestine, the more residue is accumulated, and longevity decreased. On comparison of the longevity of mammals (with well developed large intestine) and that of birds (with a very limited intestinal tract), one is struck with amazement by the

difference in their length of life. A small mammal like the ordinary mouse seldom lives more than two or three years, while a bird of the same size (a canary, for instance) easily lives fifteen years. Parrots and crows live to be 80 to 100 years old, and nothing is more striking than the meagreness of the bacterial elements in the excrements of this last named bird, of carnal habits similar to the rat.

The exceptions themselves prove the rule. Mammals such as the large frugivorous bats, which have a decidedly reduced large intestine to assist their flying, and of which the bacterial flora is decidedly poor, live to an age unheard of among the terrestrial mammals of the same size. Inversely, the large roving birds, who have a well developed intestine, live a comparatively short period.

THE HARMFUL MICROBES AND HOW THEY FUNCTION

Comparison of these facts brings us to the hypothesis of Metchnikoff concerning the rôle of intestinal flora. By what mechanism is this pernicious action of intestinal bacteria exercised? It was essential to know which were the dangerous microbes and how they acted.

One fact held Metchinkoff's attention from the beginning. A certain number of eminently toxic substances originate during the course of intestinal putrefaction. The residue from protein material following the digestive processes attacked by intestinal bacteria gives the aromatic substances such as the phenols and indol. The fact that the body has found it necessary to evoke a special defense system against these poisons (transformed into the liver as sulfo) demonstrates the fact, and the resorption of these toxins by the intestinal walls is evidence, of their toxic action. In other words, it is exactly the most commonplace of the intestinal bacteria, notably the group B coli, that is shown as the strongest producers of these poisons.

During an important series of studies, Metchnikoff and his pupils established experimentally that giving small doses of these substances in question (indol, paracresol) induced in animals sclerotic lesions with marked changes in the brain tissues, arteries, liver, kidneys, suprarenal capsules, similar to those noted in old age.

The achievement of these important studies was clearly a demonstration of the pernicious effects of the intestinal bacilli, and gave a first indication of the means to follow in order to combat their evils. *It is essential to change the intestinal flora and conditions of its activity in order to reduce to a minimum intestinal putrefaction.*

METCHNIKOFF'S METHODS OF COMBATING UNFRIENDLY BACTERIA

We know that Metchnikoff searched to attain this end, in endeavoring to suppress all intake of bacteria with food, and to set up in opposition to the putrefactive germs those of lactic fermentation. The

first group show themselves very sensitive to the effect of the latter, and are disabled and even killed when fermentation reaches a certain state.

In order to suppress the intake of "unfriendly bacteria," Metchnikoff outlawed all raw foods (except fruits protected by a thick natural covering) and demanded cooking and sterilization by heat of all food elements. Without going into details that would diverge from our subject, it is essential to state that these measures must be revised to conform to recent discoveries on the subject of vitamins, which discoveries we owe in a large measure to our American colleagues. We are particularly concerned here with the methods recommended by Metchnikoff for the modification of intestinal flora.

First of all, it was necessary to learn if the composition and function of the normal flora were especially adapted to the needs of the organism, in such a way that suppression or modification could be made without inconvenience or danger. Since the beginning of time, the mammals have sheltered in their large intestine an enormous quantity of germs, and one could well ask to what extent their collaboration with digestion had become useful or even necessary. It is thus that Pasteur thought life would be impossible without the presence of intestinal microbes.

Through the inspiration of Metchnikoff, an intensive series of researches was conducted to clear up this fundamental question. It was definitely established that various creatures (chickens, guinea pigs, tad-poles, etc.) raised in perfectly aseptic surroundings, that is to say without any visible germs, digest and assimilate as well as those of the same species given the normal bacterial flora.[1]

This important point—the non-usefulness of the normal bacterial flora—being established, nothing was opposed to our search in modifying it in a desirable manner. Based on the existing antagonism between putrefactive germs and acid fermentation on one hand, and the fact that longevity is especially pronounced among the people using an abundance of sour milk, Metchnikoff naturally concluded that the use of lactic ferments would be decidedly helpful.

We have been convinced of the efficiency of this manner of fighting the "unfriendly" germs in conditions where the lactic ferment

1. This point requires explanation. Aseptically raised animals are given sterilized food (by heat). Heat, to sterilize, destroys to a great extent the vitamins contained in the foods necessary for the development of superior animals.

Animals raised without microbes are not only aseptic, but they are a-vitaminized. They must be considered as having normal intestinal flora but nourished with uniformly heated food. Superior animals, such as chickens or guinea pigs, thus fed, developed more slowly and less satisfactorily than others of the same variety fed on raw foods. Before the vitamin era, we had noted this fact, expressing our opinion that sterilized foods caused sterile animals. (Ann. Inst. Pasteur. T. XXVII, p. 154, 1913.)

Experiments on inferior animals (insects) show that by proper feeding of these devitalized creatures, they can be brought back to normal. We thus had cockroaches reproduce normally for more than six years, or for them, 20 generations.

could be given at the same time as the sugars needed to increase the lactic acid—conditions such as infected wounds, mucous or naso-pharyngeal infections. The problem is more difficult when it is necessary to combat the intestinal bacteria. In fact, the sugars are almost completely re-absorbed in the stomach and small intestine, and do not reach the large intestine, that is, the seat of putrefaction that is hard to reach.

DIFFICULTIES IN INCREASING "FRIENDLY" GERMS

Metchnikoff endeavored to overcome this obstacle in prescribing, together with the lactic ferments, fruits rich in sugar, dates for instance, or where that substance was protected by a thick cellulose envelope against the digestive juices. Even under these conditions, only a trace of sugar appears in the large intestine.

It was essential to find something else. Owing to the impossibility of bringing the sugars, it became necessary to use the starches, which under certain conditions travel the entire intestinal tract in their original form, and are found intact in the excrements. The problem was to find bacteria especially adapted to attack the starches, and that, in dextrinizing them in the large intestine, would furnish the lactic ferments needed.

Amylolytic germs are not rare in nature. The property of dextrinizing starches frequently found among the moulds are equally found among the bacteria. A certain number of pathogenic germs, also saprophytes, produce amylases, that is, diastases capable of transforming starch into sugar. Granted, it is not a question of using the first group. As to the second (B. subtilis, B. mesentericus, M. prodigiosus, etc.), they are all not only amylolytic but also proteolytic, and therefore likely to increase rather than decrease the phenomenon of putrefaction.

The attacks on starch by these germs does not stop with dextrinization. The sugar is burned without producing acidity, or rather in insufficiently large quantity to produce water or carbonic acid. At least, these germs do not seem to adapt themselves to conditions found in the large intestine. There exists, among the constant host in this organ, a bacillus of marked amylolytic activity, the B. Welchii, but it is also a powerful proteolytic ferment, and should be classed among the dangerous germs.

After extensive research, we have succeeded in finding, among the numerous germs isolated and studied, two bacilli, conforming to this requirement. Dextrinizing energetically starches, these bacteria utilize only a small part of the sugars produced. Besides, one of these bacteria, the glycobacter peptolyticus, is non proteolytic against the very large majority of bacteria attacking starch. Administered in food to persons or animals (white rats), these bacteria in the majority of

cases brought about a decrease, more or less marked, in intestinal putrefaction, measured by the quantity of the aromatic contents of the urine.[2]

An interesting fact noted was the decrease of aromatic contents, which was especially marked when the dietary contained an abundance of potatoes, a rich source of these elements. On the contrary, the quantity of these aromatic contents was not decreased when the potatoes were replaced by white bread as the source of starch. This result, apparently paradoxical, is explained by the fact that starch from white bread is dextrinized almost entirely within the small intestine (and consequently, from our point of view, is considered as a sugar) while the starch of potatoes, protected by the cellulose, arrives practically entire into the large intestine, and is found in its natural state in the excrements.

Thus, in the two experiments on man, the quantities of phenol fell respectively from 0.080 gr. and 0.022 gr. to 0 and 0.003 gr., and the quantities of indol from 0.070 gr. and 0.030 gr. to 0 and 0.005 gr. after an eight-day administration of glycobacter. In one of these experiments on rats, the quantity of phenol and indoxyl equaling 0.080 gr. and 0.070 gr. on the potato régime decreased respectively to a faint trace, and to zero after administering glycobacter.

Without being always so uniformly good, the total results of the series of experiments is decidedly encouraging. They permit of an interesting comparison, and one in which we particularly call attention to the following:

The lowering of the aromatic contents following administration of glycobacter was observed as well in the cases where these bacteria were given alone as when the lactic ferments were given simultaneously.

Thus, if the amylolytic bacteria are infrequent in the intestine[3], this is not true of the germs capable of manufacturing acids through sugars. These, formed by the digestion of starch through glycobacter and the common intestinal bacteria (B. coli) in the first place, will act as acid ferments. The experiment is simple and clear, as follows:

Plant some B. coli in peptonized meat bouillon and the culture develops with the characteristic fecal odor, also the production of more or less indol, according to the source. The previous addition of sugar, if the quantity is sufficient[4], annihilates the trace of indol, and the repugnant fecal odor is replaced by an agreeable one of ether. According to conditions arranged, the B. coli, most frequent of the intestinal bacteria, is either decidedly putrefactive, or a marked acid ferment.

2. E. Wollman. Research. Ann. Inst. Pasteur.
3. E. Metchnikoff and E. Wollman. Ann. Inst. Pasteur. T. 26, p. 825.
4. According to Schmidt & Strasburger (Die Fazes des Menschen 3 e. bd. Berlin) p. 100.

IMPORTANT TO RENDER "GOOD" THE "BAD" GERMS

It was reasonable, therefore, for Metchnikoff to see in the B. coli an important factor in intestinal putrefaction, and consequently, one of the principal enemies. It is against it that the majority of the lactic bacteriotherapy is directed. Or, as is well known in many instances, the best means to conquer a numerous enemy is to make him a friend.

This series of facts seems to indicate that in the fight against intestinal putrefaction, it is less essential to introduce "friendly germs" than to render good the bad ones existing, in directing their activity into the proper channel. Depending upon whether the normal intestinal bacteria have at their disposal an excess of either protein or carbohydrates suitable for fermentation, the results will be either putrefaction or acid fermentation. Besides, in the latter event, the lactic ferments represented by the acidophiles of the intestine will develop without being introduced from outside (or artificially).

One well known fact substantiates this view. A nursing baby shows a bacterial flora of peculiar nature, consisting almost entirely of the bacillus acidophilus (B. bifidus). As soon as the mother's milk is replaced by cows' milk, richer in proteins but poorer in sugars, the bacillus acidophilus disappears, and the acid reaction of the nursing baby is replaced by an alkaline reaction.

We believe, therefore, that the good results obtained with sour milk or bouillon B. bifidus (associated with special diets), modifies the intestinal contents to a greater extent than the lactic ferments.[5]

INFLUENCE OF DIET ON THE FORMATION OF THE PRODUCTS OF BACTERIAL DECOMPOSITION FOUND IN THE URINE

From the beginning of these researches, Metchnikoff had recognized the importance of diet in relation to the question of intestinal putrefaction. During the course of these experiments, Metchnikoff and I have studied a large number of different régimes with reference to their influence on the production of the aromatic bodies (indoxyl and phenol sulphate) found in the urine. These experiments were made on white rats, an animal essentially suited for this type of study. Placed in cages permitting the gathering of urine, the animals were put on diets consisting of one or several ingredients of either animal or vegetable origin. In general, the rats fed with one lone article of food of animal origin gave urine containing a much greater quantity of aromatic substance than the vegetarian rats. The rats fed hard boiled egg gave urine containing 0.165 gr. phenol and 0.200 gr. indoxyl to the litre.

5. It is possibly the same for the favorable results that no one seems to obtain from the lactic acid tablets. We have been assured that even under the most favorable conditions, these tablets do not contain live bacteria. Oftenest, they contain the B. subtilis. However, the thickened lactos of which they are composed would disintegrate slowly and thus penetrate a considerable distance into the intestinal tract.

Those getting bits of chicken eliminated 0.150 gr. phenol and 0.350 gr. indoxyl, and those given carrots only eliminated 0.008 gr. phenol and 0.006 gr. indoxyl.

However, certain vegetable products give, in the rat, high quantities of these aromatic substances, sometimes greater than those obtained by the use of nourishment of animal origin, cottage cheese being an example of this. It gives only 0.05 gr. phenol and 0.033 gr. indoxyl, while potatoes and bananas furnish respectively 0.070 gr. phenol and 0.080 gr. indoxyl; 0.227 gr. phenol and 0.122 gr. indoxyl.

It is evidently a mixed diet, given an omnivorous animal such as the rat, that obtains the best results. During the course of some experiments, which I have not previously recorded, I observed that a mixed diet of bread and meat showed a decrease of aromatic contents more marked than a diet composed exclusively of either article.

INFLUENCE OF DIGESTIVE FUNCTIONS ON PUTREFACTION

Aside from these facts, which we have discussed at some length, the third factor remains, the importance of the digestic functions on determining the intensity of the intestinal putrefaction. It is on the residue from the digestive function that the activity of the intestinal bacteria is directed. Following the more or less complete use of the various food elements, the residue furnished the intestinal flora can vary more or less markedly. This indicates the possibility that the intensity of intestinal putrefaction can easily vary from one individual to another, and even vary from moment to moment in the same individual. This explains the experimental fact that, in the great majority of cases, intestinal putrefaction, measured by the aromatic contents of the urine, is always intensified during the early portion of the régime. Afterward, there is a certain adaptation, permitting better utilization of the food elements furnished, and reducing at the same time the amount of putrefaction. Beyond the shadow of a doubt, this explains the greater efficiency of the glycobacter treatment in its earlier stages. The more complete digestion of potatoes later provides a smaller quantity of starch for the large intestine to be transformed into sugar.

The problem of intestinal putrefaction and its treatment is rather complex. Added to the early general findings of Metchnikoff are the results of the experiments described here. In this new branch of pathology, the same as in the others, it is evident that there are not diseases, but the diseased.

OTHER ELEMENTS CONTRIBUTING TO SENILE INTOXICATION

It is entirely possible, also, that outside of the aromatic substances studied by Metchnikoff and his assistants, other elements of bacterial

origin contribute to senile intoxication. We shall not be certain concerning the definite rôle of intestinal putrefaction in Nature until we have succeeded in keeping alive superior animals for sufficiently lengthy periods without intestinal flora. Studies on the span of life of these aseptic animals, and of others with normal intestinal flora, would fix definitely the part belonging to this flora in senile intoxication. Already science has been successful in raising under perfectly aseptic conditions, and keeping them for several years, some of the lesser creatures (insects). The success attending these fatiguing labors permits us to hope that similar success will be realized in the near future for superior animals; in fact, such experiments are now under way in our laboratories.

However, from now on, thanks to Metchnikoff, the path is open for the scientific study of "old age." The example we have of the almost normal old age of birds shows definitely that the decrepit and degenerated senile cannot be considered as the normal and physiological body, but that it is the result of an additional process, though constantly found, and that we must seek for the cause of senile lesions.

In teaching this, Metchnikoff has given us an unfailing hope.

A CHEMOTHERAPEUTIC INSTITUTE—ONE OF THE GREATEST NEEDS OF MANKIND

Dr. Arthur S. Loevenhart, Professor of Pharmacology and Toxicology, University of Wisconsin

If one carefully examines our great medical schools and makes a survey of all the scientific laboratories, both in the medical schools and in the independent research institutes, he will arrive at the striking conclusion that there is no adequate provision being made at the present time for improving the methods of treating the sick. Great advances have been made recently in treatment, but no adequate facilities exist anywhere for a scientific attack of the great problems of treatment of the sick that face the doctor every day at the bedside. Great therapeutic discoveries were made before the era of modern medicine, but they were relatively few, and we may mention, in passing, only opium, iron, mercury, quinine, digitalis, potassium iodide, general anesthetics, and others. With the increase in knowledge regarding the morphological changes in the tissues, and the appearance of Virchow's Cellular Pathology, it became increasingly apparent that most of the methods of treatment handed down through the ages were without value. Because of inertia and because of the necessity of doing something for the sick, old methods of treatment have, however, continued very largely to the present time. Osler was largely responsible for the period of therapeutic nihilism, from which we are just emerging. This period of nihilism was of great benefit, since it tended to clear the decks for the battle to find really valuable therapeutic agents in the light of greater knowledge and more accurate observation. The result has been, however, that therapeutics has fallen into a sort of disrepute, and clinicians have turned their attention from therapeutic studies to attempts to determine more accurate methods of diagnosis and the study of the natural history of diseases from a statistical standpoint. The whole movement has resulted in a serious imbalance between diagnostic and prognostic aspects of medicine, on the one hand, and serious efforts to improve treatment, on the other.

Many clinicians pride themselves on their diagnostic ability, realizing that effective treatment often is not possible at the present state of knowledge. They lose interest in the patient after the diagnosis is made until an autopsy is performed in order to determine the correctness of the diagnosis. It is obvious that diagnosis is not an end in itself but only a means to the end that effective therapy may be insti-

tuted. The patient is not vitally interested in the diagnosis but in the treatment that will result in his restoration to health.

EHRLICH'S WORK ILLUSTRATES WHAT CAN BE DONE BY CHEMOTHERAPEUTIC STUDIES

Efforts to improve treatment in recent times have been, in most instances, spasmodic. Thus, Banting's discovery of insulin represented, at the beginning, the efforts of one man, who apparently had difficulty in obtaining facilities for his work in the earlier stages. Ehrlich's work on the development of salvarsan is an outstanding exception, and can well be used to illustrate what can be done by chemotherapeutic studies. Ehrlich had working with him a group of synthetic organic chemists and also a group of clinicians. He himself did the preclinical biological work with his associates. They started out with the discovery of Thomas and Breinl, in 1905, that atoxyl clears the blood of mice infected with Tr. brucei. The trypanosomes are organisms closely related to treponema pallidum, the organism of syphilis. Beginning with atoxyl, Ehrlich prepared a very large group of derivatives more or less closely related to atoxyl. Among these substances was arsenophenylglycine. This substance possessed excellent properties in the treatment of syphilitic infection in animals, and was used in the treatment of trypanosomiasis (South African Sleeping Sickness) in man. It was finally discarded by Ehrlich as inferior to salvarsan. This substance was the best that had been discovered up to that time in the treatment of the acute stages of syphilis, but it had the great disadvantage that it was difficult to put into solution, and a large volume of water had to be used in making the injection of the substance into a vein. In order to correct this, Ehrlich prepared neosalvarsan. This substance passes into solution readily, does not require neutralization, and can be injected in a small volume of water.

A DRUG FOR TREATMENT OF LATE SYPHILIS OF THE CENTRAL NERVOUS SYSTEM

There has been a tremendous reduction in the incidence of syphilis all over the world since the introduction of the salvarsans. These drugs proved a great disappointment, however, in the treatment of late syphilis of the central nervous system. Research was begun at the University of Wisconsin in 1919, directed toward the finding of an arsenical drug that would be useful in the treatment of general paresis—the worst form of syphilis of the central nervous system. Ehrlich had prepared phenylglycine-p-arsonic acid, and found it to be totally inert as a therapeutic agent. Jacobs and Heidelberger, of the Rockefeller Institute, made the amide of this compound, and Brown and Pearce

found this substance to be exceedingly useful in trypanosomiasis in animals. It received from the Rockefeller Institute the name, tryparsamide, indicative of its use in trypanosomiasis. The drug was then studied at the University of Wisconsin by Lorenz, Bleckwenn, Hodges and myself, in the treatment of general paresis, along with a large number of other arsenical drugs. It soon proved to be the substance for which we were seeking.

During the experimental stage of this work, we succeeded in restoring 100 men to society, and most of these are still earning a living for themselves and their families. The saving to the State of Wisconsin alone during the experimental part of this work could not be estimated at less than $500,000. In the first two years that tryparsamide was placed on the market (January 1, 1925, to January 1, 1927), 243,600 doses were sold in the United States, which means, on a conservative basis of forty treatments per patient, that 6,000 patients have received tryparsamide treatment in this country.

At the lowest estimate, 40 per cent of the patients treated were restored to sanity, or were prevented from becoming insane, through this treatment. Since paresis is almost uniformly a fatal disease, running a very chronic course, it probably means that the country has saved approximately three million dollars in the medical care of these patients, without attempting to estimate the loss that would have resulted from their enforced idleness.

STUDIES OF LOCAL ANESTHETICS

Turning our attention to another aspect of chemotherapy, may I call your attention to the results of chemotherapeutic studies in my laboratory on the subject of local anesthetics? The best local anesthetic is one in which there is a very large margin between the amount of the drug required to produce anesthesia and the amount required to kill. The two factors, then, are anesthetic efficiency and toxicity. The longer the anesthesia produced by a non-toxic dose, the better the drug; the larger the dose required to kill, the better the drug. So that, by multiplying the duration of anesthesia of a sub-toxic dose by the amount required to kill, we arrive at a therapeutic index, which represents both anesthetic efficiency and toxicity. As a basis of comparison, we have used cocaine, and the two series of drugs studied are (a) amino ethanol esters of p-amino benzoic acid and (b) the corresponding trimethylene derivatives. These substances were furnished by Dr. Roger Adams of the University of Illinois. There was a marked increase in toxicity in the trimethylene series over the dimethylene series, and the therapeutic index in the dimethylene series was practically equal. Substances

of the trimethylene series, also, all have the same therapeutic index, but the therapeutic index in the latter case is the same as that of cocaine, whereas the dimethylene series have a much higher index, being over 2¼ times as great. The best substance of this whole group, therefore, would seem to be p-benzoyl-di-iso-propyl-amino-ethanol-hydrochloride. There are other essential properties to local anesthetics that depend, in a measure, on the way in which they are used, but these need not be gone into here, since we are seeking simply to illustrate types of chemotherapeutic investigation.

PROBLEMS IN ARRIVING AT AN EFFECTIVE DRUG IN THE TREATMENT OF EPILEPSY

Innumerable problems of therapeutics await similar types of investigation. Thus, in the study of drugs used to produce depression of the central nervous system, we may note that while barbital is an excellent sleep-producing drug, it is not useful in the treatment of epilepsy, whereas luminal has great therapeutic value in this condition but is a very poor hypnotic. In other words, the substitution of a phenyl for an ethyl group makes the drug much more selective for the motor cortex, the part which we want to depress in cases of epilepsy, and less active for reducing the excitability of the sensory and psychic portions of the brain. It is obvious that if we could prepare the diphenyl derivative, we might arrive at a still more strikingly effective drug, for the treatment of epilepsy, that would cut down the irritability of the motor cortex without producing mental dullness or drowsiness. Unfortunately, this drug has not been produced as yet, but there are obvious other derivatives that could be made and studied from this viewpoint.

OTHER DRUGS NEEDED

We are sadly in need of drugs that will prevent pain after operation and permit recuperative sleep. It is obvious that such a drug would promote recuperation from surgical operations. Morphine does not supply this want (1) because it is habit-forming and (2) because it does not promote recuperative sleep. It is, however, the most potent drug we have at the present time for preventing pain.

We also require more innocent and certain drugs for the production of sleep. Insomnia is undoubtedly a very potent factor in the production of nervous exhaustion which in turn may lead to serious mental illness. The exhaustion factor in acute disease, in general, plays a large but unknown part in delaying recovery.

We need better drugs for purposes of resuscitation. We require a more complete knowledge of the effect of drugs on immunological processes. We are constantly seeing patients with malignant endocar-

ditis, and we have no satisfactory way of stimulating immunological processes. It was shown by Dr. Ludwig Hektoen that sodium iodoxy-benzoate is capable of greatly increasing the production of hemolysins, whereas sodium iod-benzoate, which contains no active oxygen, is entirely without such effect. Dr. Samuel Amberg has shown that sodium iodoxy-benzoate greatly retards the local inflammatory reaction to many irritants, whereas sodium iod-benzoate is inert in this regard. There is great need of production of many other active oxidizing agents for study along these lines, and some of them should be useful in the treatment of certain types of infections.

In order to do work of this type, it is necessary to have organic chemists, pharmacologists and clinicians working together in perfect harmony, and there should be ample facilities for the three types of work. The institute should be closely affiliated with the medical school and university, at a place where ample clinical facilities would be available.

THE WORK OF THE INSTITUTE

The therapeutic institute that I have in mind should seek to evaluate accurately various therapeutic procedures that are at present in use. It should avail itself of all the aid that it could receive from chemists throughout the country and from all pharmaceutical and clinical organizations. It should confine itself to types of research that, if successful, could be immediately applied to the treatment of the sick. Fundamental biological problems should be left to the many scientific laboratories in existence.

The institute should carefully scan the literature of the world for therapeutic suggestions, and should from time to time issue bulletins to physicians as to the value of new therapeutic procedures, giving sufficient detail for the physician actually to use such therapeutic advances as appear from time to time, together with its own critical comment of the limitations and any possible dangers associated with the new procedure. Chemists working in universities should be encouraged to send in their substances for biological study.

The therapeutic advances that have been made in recent years, even in the absence of adequate facilities, are a sufficient guarantee that the institute would be able to justify itself almost from the beginning.

Therapeutics is the one great neglected field in medicine at the present time. We have splendid facilities for applying known methods of treatment, splendid laboratories for the investigation of the fundamental problems in the medical sciences and for the cultivation of chemistry, but we look in vain for any institute or laboratory, with adequate facilities, devoted to the great problem of trying to find new

methods of treatment. A mere fraction of a per cent of the money given for medical advance is devoted to efforts to advance therapeutics.

In conclusion, for the advance of chemotherapeutics, it is necessary that chemists, pharmacologists, and physicians work together as a team. The men selected must be chosen on the basis of their ability and their characteristics of personality that enable them to work effectively in such a cooperative effort.

It is important that the great need of such a chemotherapeutic institute be called to the attention of those men and women of the country who have means which they would like to expend in the interest of all mankind. Advances in therapeutics are of no pecuniary advantage to the medical or pharmaceutical profession. The physician will always be called in cases of distress, regardless of what he may be able to do to relieve it. An advance of therapeutics is the heritage of the race for all time.

THE ULTIMATE MISSION OF CHEMISTRY

Dr. Charles H. Herty, Advisor to the Chemical Foundation, Inc.

I am going to take you into an entirely different frame of mind from that you have been in this afternoon. I want to get you into a dynamic mood as to what is your part in this whole story. And when I say your part, I do not mean you right here in this room, but I mean people all over this country who represent its great citizenship. I am justified in doing this when I look at the program of this meeting for the purpose of discussing ways and means of applying science to human living in the same thoroughgoing way that it is now applied in industry. It has been my good pleasure to be closely associated with chemical industry during the past ten years, and I want to say to you what I have said to those men in the industry many and many a time, that the ultimate mission of chemistry is not the creation of wealth, about which we have heard so much within the last decade. Chemistry has a higher mission, and we cannot be satisfied until given an opportunity to realize that mission; namely, the ultimate mission of chemistry is health.

Now, how are we going to get to it? I hope there are some psychologists in this audience. This is a Conference; we are here to confer together. I have come here more largely to get information than to give information. At the same time, I do want to show that all of us have part of this job to look after, to get at the state of the public mind, because it amazes me just where we stand in this country today; it is hard to understand.

Take a case like that of the railroad crash in Chicago the other day and how they spread it on the papers. How thrilling it is. The whole country's attention is called to it. And yet, while that very thing is going on, in many homes in this country today people are dying, absolutely unable to be helped by the best medical care in the country, and yet we do not get excited about it. What is the reason for that?

Take another case. New York City will talk for a long time about Ruth Snyder and her conviction and the fact that she was electrocuted. But I just left the South a few days ago, the home of a dear friend, who I know is as definitely sentenced to death as Ruth Snyder was. This friend has had her left breast taken off by an operation for cancer. The doctor says she cannot last more than six

months, that she is going to die as surely as can be. She is condemned to death because we do not know how to control cancer.

STRICTLY FINANCIAL LOSSES

Go down to Washington today, listen in Congress to what they are talking about—flood losses in the Mississippi. It was a great disaster and we are talking about what to do for it. Do you know that the losses from the Mississippi floods are estimated to be about two hundred and fifty million dollars? We are trying to get a program of how to prevent those losses in the future. You can get the ears of the people of the present, and of congressmen and senators about this Mississippi flood situation, this great disaster, which kept the eyes of the nation focused on that whole central part of our continent. And yet—here is the point I want to make—while the Mississippi flood caused a loss of two hundred and fifty million dollars, and we do not want it to occur again, do you know what is a fair estimate of the economic loss annually in this country because of our lack of knowledge of applying science and particularly of chemistry to these problems of health? It is at least fifteen billion dollars a year that we lose in this country from sickness and death.

And I mean preventable death, not death from old age. Get at it from the figures on the annual sickness bill of the nation. The hospital information bureau in New York has given me the figures on money invested in hospitals. Five per cent interest on that for hospital maintenance and you have right there a figure of over a billion dollars expended annually as a repair bill on the human machine. That is direct expenditure. I wonder if any of you read Dr. Louis I. Dublin's article in *Harper's Magazine* last December in which he showed that the estimated value of the lives lost through preventable sickness alone in this country annually amounted to six billion dollars, that the loss of time, the loss of wages, of earning power, due to sickness, amounts to two and a half billion. Don't you think that certainly the losses—if Dr. Dublin's figures of six billion a year are anywhere near right—that certainly the losses from those forms of sickness that we do not know how to control or prevent represent at least an equal amount? It is in line with what Dr. Chapin said at the American Public Health Association—that what we do not know is a great mass more than what we do know about these matters. So I presume a figure, therefore, of fifteen billion dollars represents what is going out every year in the way of losses from the conditions stated. The Mississippi flood comes at intervals of years, but this is going on every year. It is a direct loss that can be calculated.

NO ADEQUATE ACTION TAKEN TO PREVENT SICKNESS

I would prefer to keep this discussion right down to the matter of arguing this out on a strictly financial basis, keeping sentiment out of it. And yet I want to tell you of a little experience I had last week which you may probably have had many times yourselves. I was down in my old home in Georgia where everybody knows everybody else pretty well. They got to asking me about the wonderful advances of science, what it had done to create wealth. After awhile the conversation drifted down to what was the matter with so and so who lived on this corner and somebody else on that corner, and I noted down the cases of sickness all around. There was a case of cancer three squares from us, a case of tuberculosis two squares from us, a case of pneumonia a little farther down the street, a case of encephalosis and a case of infantile paralysis right in the same neighborhood. My own wife was down there at this time because her doctors in New York had tried for fifteen years to cure bronchial asthma—had never done it yet —and she was trying a change of climate. Also there was a case of hay-fever across the street, and a dozen people suffering from colds. I said to one of the members of the Public Health Association, "Do you know anything about the common cold?" And he said, "No, but I am suffering from it right along." That is the problem. People are interested in all the wonders of science, all that science has done in creating new wealth, and things of that sort, while they take the matter of sickness as a kind of necessary evil, and take no adequate dynamic action to find out why and do something for it and get rid of it all.

THE BODY IS THE GREATEST CHEMICAL FACTORY

That is the frame of mind of the American people of today. Why can't we do more to get rid of this great source of financial loss and some of this sorrow and suffering? Why can't we do it? They talk about the great wealth that has been developed here through chemistry, the wonderful strides of chemistry particularly since the War—that is, organic chemical industry, the medicines, the synthetic flavors, the perfumes, and these new lacquers for your automobile. But do you know what is the greatest chemical factory in this country? It is your own body. There are one hundred and fifteen million of these human factories scattered all over the country, nothing in the world but organic chemical factories.

Let us see what kind of a factory the body is. Needing study most important of all is the fundamental cell, for in that cell you have the production of organic chemical compounds going on all the time; you have got some of the most intimate questions of colloidal chemistry in the way of the material that enters and leaves those cells. You have

all those hormones, which have been referred to already this afternoon, those slight traces of compounds which bear tremendous relation to our activities. I heard Dr. Kahn of Park, Davis and Company read his beautiful paper in Columbus last Saturday in which he showed how, in getting down to pituitary extract, it took the glands of 500,000 cattle to get a very small bit of the substance with which he is working. He has shown for the first time that it is made of two distinct things, whereas it was thought to be one before, and now he is just beginning to get to the chemical work connected with it. Then the question of oxygen. We breathe it, it oxidizes, gives off carbon dioxid. Go look at the work of the Public Health Service and the work of Kendall, at the Mayo Clinic, and other men who are working in this field and see what a tremendous change is coming over our thoughts about the relation of oxygen in our body and the evidence that indicates pretty clearly that it is very possible that our whole views of physiologic diagnosis must be modified or in some cases completely changed. That is very fundamental, but it is coming about through the work of these few scientists. We talk about chemical equilibrium in plants. Some of the most beautiful prospects have been worked out in industrial chemistry. Possibly right now in Pittsburgh for the first time the steel manufacturers have gotten the idea that the question of the manufacture of steel is a question of chemical equilibrium. Chemical equilibrium studies of the body have never been made, but must be made.

$40,000 FOR CHEMISTRY TO AID HEALTH—$10,000,000 TO ELIMINATE CORN BORER

The question comes in finally, What are we going to do about all this?

I have the highest respect and regard for the work being done by the endowed universities of the country, but is enough being done? Who is supporting it? A few wealthy people are endowing institutes and universities, and yet keep this thought in mind: Every citizen of the country is subjected to this financial loss, to sickness. He talks about the wonders of science. What are you doing today in the way of spending your money to support research and the fundamental problems of life, and what is everybody else doing? I tell you one way in which it is showing up. I will tell you how much of your taxes were spent last year by the Public Health Service to support chemical work on problems relating to health. Thirty to forty thousand dollars is all that the chemical division has received, against ten million dollars to eliminate the corn borer.

AN OPPORTUNITY FOR ASSISTING FUNDAMENTAL RESEARCH

Because of the above, Senator Ramsdell of Louisiana has introduced a bill that I think has more basis of good in it than anything else ever

introduced. It is a bill that provides for the administration of the Parker Bill before Congress to coordinate the work of the Public Health Service. It provides an initial appropriation of eight million dollars through a National Bureau of Health within the Public Health Service for fundamental research on problems of public health, to authorize the Public Health Service to receive donations from citizens who wish to endow research, and finally to create an association of Fellows who are government officers. Hearings are going to be held on that bill in March. We hope by that time that the voices who make themselves heard in Washington may find their way throughout the nation to let the people know that here is an opportunity for the individual citizen to do his share, in his own interest, in providing adequate facilities to supplement the work already being done so beautifully in our universities and endowed institutions. Let this great government extend out as a supporter of fundamental research for the health of its people and through their stimulation create wider interest in more endowed institutes, in larger appropriations for state universities and for medical schools.

We boast about America and its prosperity, about the great accumulation of wealth throughout this country. The last Congress studied the Ramsdell Bill, but could not get the approval of the director of the budget, General Lord. Let us suppose that these people who die from preventable and non-preventable diseases are not worth a cent. We still have that repair bill of a billion dollars, and an appropriation of ten million dollars is only one per cent of that. When you take into consideration all the losses that were shown by Dr. Dublin and cut them down to one-third, that is hardly a starter, but it will show a good will on the part of our Congressmen and our students to see that people are treated as well as the cows and the pigs.

THE DEVELOPMENT OF THE DEMAND FOR YEARLY HEALTH AUDITS A STRONG FACTOR IN RACE BETTERMENT

Dr. Franklin H. Martin, Director General American College of Surgeons and President of the Gorgas Memorial Institute

The development of the demand for yearly health audits is a strong factor in Race Betterment. Prospective fathers and mothers whose progenitors were, from a racial standpoint, of the fittest, cannot hope to preserve that supremacy in themselves or in their offspring if they fail to observe the rules of prudence in an effort to maintain healthy bodies, and if they do not practise wholesome living.

These prospective fathers and mothers, born of these superior parents, must meet the present civilization, must develop character by using their own wings in independent flight, and must solve their own problems in a world that no longer tolerates chaperones or too much parental supervision. They must map out their own course, attempt to do their own thinking, and adopt their own rules of living in order to conform to their present popular academic institution usages. This applies fully as much to their habits of health and to their physical development as to their moral and intellectual education.

From babyhood, unconsciously, they are absorbing the teachings of scientific medicine and sanitation. For fear of "microbes," they must not kiss other than father, mother and pampered aunts; and they must take their food and their drink from sanitary nipples, sterilized spoons, and individual drinking cups. With the forbidding red and yellow placards, they must be quarantined for scarlet fever and for smallpox. They must be vaccinated for smallpox, scarlet fever and typhoid fever, and they must be inoculated with antitoxin for diphtheria.

During these trials, childlike, they ask a reason for all of these precautions; and the enlightened parents, in these advanced days, are able to make satisfactory and true answer. Finally, as they grow older, they hear of child welfare work, which advocates the examination of children; of the work of the National Tuberculosis Association, of the American Society for the Control of Cancer, of the American Heart Association, etc., each of which organizations advances convincing reasons why a periodic health examination should be sought by the individual to ascertain whether or not he is suffering from the specific disease that the particular society is combating.

Then there is the American College of Surgeons, which through its public health meetings and through the lay press is telling the people what scientific medicine really is. The College, together with the

American Medical Association, State and County Medical Societies and the Gorgas Memorial, has been carrying on an active campaign for better health, with the slogan that each individual should have a *thorough and complete periodic health examination* that would reveal to him any or all preventable diseases in their early stages.

All of this enlightenment in scientific medicine, all of this propaganda, has caused the prospective father and mother—and all other wise people—to reflect upon the advantages of health audits, and many of them are acting upon the lesson they have learned to the extent that they are seeking practical conclusions by offering their bodily machines for a scientific health audit at least once each year. It is estimated by the Gorgas Memorial that, in 1927, 5,000,000 individuals asked for periodic health examinations who had never before sought such service. Educated and thinking people are increasingly demanding periodic health examinations, and we predict that within five years at least fifty per cent of the one hundred twenty-five million inhabitants of the United States and Canada will demand this valuable service.

And what a human salvage this practice will bring forth!

What a profound bearing this will have upon Race Betterment! Toward making life worth living! Toward the prolongation of useful lives!

For the hitherto unsolvable difficulties in the conduct of a successful health examination by the personal physician, here is a suggested solution:

THE DIFFICULTIES ENCOUNTERED BY LAYMEN, PRACTITIONERS AND ORGANIZED MEDICINE

The prospective parent having done his own thinking, and having arrived at the conclusion that it is wise that he shall seek a periodic health audit, presents himself, as he has been advised, to his family physician, after having procured a comprehensive blank from the American Medical Association, the State, County, or some other authoritative Medical Society.

The physician receives the applicant and discovers that the prospective patient is not a patient at all, but apparently a normal person, carrying an elaborate record form against which he expects the physician to check his bodily condition, and record negative and positive findings.

Meantime, the physician has gained a reputation and a livelihood from the practice of medicine in a community by the exclusive care of sick individuals. But he has become aware of the propaganda advocating preventive medicine, he has recognized the reasonableness of it, and this handwriting on the wall has caused him some anxiety. How shall he meet the demand? He is well equipped as a physician, as he

was graduated from a Class "A" medical school. He has kept abreast of the times by attendance at medical society meetings, and by the perusal of the best medical literature. He may have taken precautions through extra study, at a university clinic or a hospital, in the intricacies of a complete and thorough physical examination.

And yet, all of this makes him recognize the fact that he has not the equipment that will make it possible for him, on his own, to examine a patient adequately and give honest answers to the questions contained in the comprehensive blank provided for physical examinations.

The obvious difficulties have thus far been insurmountable in the eyes of those authorities in organized medicine who have advocated the advantages of the health examination, and unless the simple method that I am now presenting proves as effective as I believe it will, the problem is still unsolved.

Briefly, organized medicine, in considering the difficulties of the problem, has had to consider:

1. How can equal privileges be offered to all legalized practitioners of medicine in this preventive measure of personal health?

2. How can an individual be prevented from abandoning his personal physician, and yet not suffer disadvantages in the thoroughness of the examination?

3. How can the individual be accorded the full facilities offered by the few established diagnostic clinics, the medical schools or the staffs of hospitals, and the practitioner of medicine be assured that he will not forego the privilege of examining his own patients, and not be faced with the possibility of losing his client if treatment is found necessary.

4. How can the practitioner pursue a course, proper and thorough, in the conduct of periodic health examinations, if we do not furnish him with the necessary laboratory facilities, trained technicians, and other essentials?

5. How can we protect the thousands of independent educated practitioners from the menace of unscrupulous groups, from unethical diagnostic clinics, from unworthy trade union tactics, and from the subtleties of criminal quacks?

Think carefully on this subject for just one minute!

How many practitioners within the hearing of my voice could, unaided, make a complete physical examination of a patient, even though he had at his disposal all of the laboratory and other diagnostic facilities? How many distinguished internists, surgeons, or other specialists would attempt such an examination without the assistance of a number of expert technicians, and occasionally one or more confreres of other specialties?

Where are the necessary laboratory facilities, the technicians, and groups of specialists found under one roof? In less than a dozen group clinics. In less than a half dozen diagnostic clinics, aside from dispensaries for the treatment of the ambulatory poor in medical schools. In the 1,800 to 2,100 standardized hospitals!

In which of these organizations can the independent practitioner best obtain welcome and be furnished with all of the facilities and the assistance necessary to make a thorough examination of his patient and retain his control and make his own charges for services rendered?

We believe that the standardized hospitals, because of their large number, their independence, their uniform equipment, and their financial backing, will best serve the greatest number of people with the least inconvenience and all members of the medical profession; and this coordination would not disturb in the least the established conventions of medicine.

A HEALTH INVENTORIUM

We are advocating periodic health examinations, not by specialists alone, but by the family practitioner, the patient's own doctor.

To save the profession from state or socialistic control, or from other strongly entrenched interests, in the matter of caring for personal health, a simple and practical solution is herewith tentatively suggested that will allow the family practitioner to examine his patients with the same degree of thoroughness and scientific accuracy that can now be accomplished by the comparatively few specialists who command the facilities of large organizations.

THE PLAN

There are more than twenty-five hundred hospitals in the United States that are under survey. Of these, approximately eighteen hundred are known as "standardized" institutions. Others are rapidly qualifying.

A careful yearly survey of hospitals is conducted by the American College of Surgeons, which has furnished the MINIMUM STANDARD. The estimate of those qualified is determined by this survey, the results of which form the basis of the annual report on hospitals that is published by the College.

Each of these standardized hospitals has the facilities, and can furnish the practitioner with the necessary equipment and aids, to insure the comprehensive examination of a patient.

Many hospitals, especially community hospitals, already furnish such facilities to the legalized practitioners, specialists, and others, within their county.

What would be the additional load if all legalized practising physicians were included? After eliminating from the 160,000 physicians of the United States and Canada those practitioners who have ceased to practise medicine, and those who are already adequately furnished with hospital or other diagnostic facilities, there would remain, based on careful compilation, an average of not more than sixty practitioners who would in the course of a year occasionally seek the aid of each hospital in examining apparently healthy individuals.

THE REQUIREMENTS

The hospital shall furnish an examining room or rooms, to which any legalized practitioner, who is a member in good standing of his respective County Medical Society and the American Medical Association, may bring a patient for examination.

The hospital shall furnish to the practitioner every facility in the way of aids, consultants when necessary, laboratory tests, etc., as will insure a comprehensive audit of his patient's condition. The charge for the required laboratory tests shall be nominal, and a minimum of actual cost. There shall be no charge for the use of the examining room. The physician shall render to the patient a bill covering his fee for the examination, and where there is a charge for laboratory services, he shall be responsible to the hospital for its payment.

SAFEGUARDS

1. To insure protection to the practitioner, no hospital shall accord these facilities to any individual who is not accompanied by his or her doctor, or who does not carry a letter from his or her doctor in which certain services are requested.

2. An individual who applies for an examination and who has no physician shall be referred to a duly appointed, disinterested committee consisting of a representative or representatives of the County Medical Society and the standardized hospitals of the community, and this committee shall advise the patient in the selection of a physician.

3. Each hospital volunteering to establish such facilities will be accredited as conducting a Health Inventorium.

THE ADVANTAGES

It does not require much imagination to convince one of the advantages of this plan—advantages to the hospital because of the opportunity for greater service to the public; advantages to the layman because of an additional assurance of scientific service by his own physician; advantages to the practitioner because of the greater facilities for service to his patient. It will bind together a trinity of interests that will help to stamp out the subtle irregulars as no other method could do.

The hospital department of the American College of Surgeons has considered the above plan with great care. A tentative survey of a number of community hospitals on the approved list of the College, and presentation of the subject to several groups of practitioners, as individuals and as members of the County and other Medical Societies, has brought enthusiastic approval. The plan has been recognized as a sure and effective means of handling the problem of periodic health examinations, and one in which all interested parties will receive just consideration.

An alternative and additional plan, one that would apply particularly to the larger cities, would provide for the establishment of endowed public diagnostic clinics (a comparatively new feature), in addition to the Health Inventorium in standardized hospitals.

The above plan, when accepted—as I am sure it will be, by the community hospitals—will solve the problem of periodic health examinations, and guarantee to the public satisfactory service from the whole profession.

It will aid in the early recognition of preventable and curable diseases, and insure their elimination. It will make possible the maintaining of disease-free men and women, and increase the probability of the birth of disease-free children.

It will stabilize life extension, and make the life that is lived more wholesome.

Finally, it will be the greatest single boon to Race Betterment, and the redemption of the world from semi-invalidism, suffering, and unhappy existence.

RACE BETTERMENT AS INFLUENCED BY THE SELECTION AND TRAINING OF MEDICAL STUDENTS

HUGH CABOT, M.D., Dean of the Medical School, University of Michigan.

There will probably be little dissent from the proposition that Race Betterment is intimately associated with the progress and development of medical practice. In one way or another the physician has, since time immemorial, exerted an important influence on the race, although it is not difficult to think back to the day when his effect was quite as much through the faith that people had in him as through any actual influence that he had on the incidence or progress of disease. During the last century, however, the actual relation between the practice of medicine and the health of the people has become increasingly important, and civilization is becoming more and more dependent upon its ability satisfactorily to combat and control disease than at any earlier period.

It is perhaps true that the rise and fall of civilizations has been nearly if not quite as much affected by their struggle with disease as by their better recorded struggles with each other. With the increase of population, control of disease becomes increasingly important, and failure to master infectious diseases might easily wipe out our present civilization. Moreover, diseases as we think of them are not stationary and isolated entities, but alter behavior and incidence with the ebb and flow of population and with the altered living conditions that go with changing conditions of environment.

We are justly proud of our falling death rate, there being perhaps nothing which the last quarter century has done, notwithstanding all of the important scientific discoveries with which we are surrounded, that is more far reaching than its ability to control or even abolish diseases that once took heavy toll of the community. We also observe the falling birth rate, which appears to accompany increasing civilization and we may well look to the day when with a very much decreased birth rate and an enormously decreased death rate we have, on the purely material side, a much more efficient population.

THE PASSING OF THE GENERAL PRACTITIONER

While these facts are of common knowledge and wide recognition, much less familiarity exists with the changed and changing relation of the physician to the community, yet even superficial consideration will indicate that such must inevitably be the case. At an earlier day, though well within the memory of many of us, there was practically no

true prevention of disease and relatively much less cure of disease than was generally believed. The great service of the physician to the community was largely in his ability to mitigate the symptoms, to relieve suffering and to advise his patients as to the probable outcome. This was the environment in which flourished the old and great general practitioner—a term in that day practically synonymous with the "family physician." He was a great man and occupied an outstanding position in the community, although we may now admit without slighting him that his knowledge of the diagnosis and treatment of disease was pretty meager as compared with modern methods. He could and did practise the healing art to the full extent of the possibilities of that day with a very moderate equipment consisting of a few drugs, a few instruments, great wisdom and a fund of common sense.

He played a great part in the drama of the day, but he is gone with it, as much beyond recall as the pony express, the Concord stage and the little red school house. He would be quite impotent to practise modern medicine with the equipment that in his day was quite sufficient, and he would cut but a sorry figure in the present practice, both of preventive and curative medicine. Diseases with which he had an all too great familiarity, such as smallpox and typhoid fever, are today almost preventable if the world decides to do without them. Diphtheria and scarlet fever are rapidly following in their wake under a similar proviso, and others of hardly less importance could readily be brought to mind.

The helplessness of the earlier practice of medicine in the face of many well recognized diseases has given place to large probability of cure under the same conditions but with newer methods of attack. Among these may be mentioned syphilis in its earlier stages, diphtheria, some types of pneumonia, cerebral spinal meningitis and others. The development of surgery has brought with it possibilities of cure of conditions commonly or universally fatal, but these beneficent results cannot be carried out with the equipment of an earlier day. They require not only added and complicated methods both of diagnosis and of treatment but a very different preparation of the physician who is to steer an accurate course on the far better charted but more complicated seas.

The physician of today, and perhaps more his successor, must be a very different person from his prototype of a century or even half a century ago. The old general practitioner has gone as have the conditions that existed in his day, and the modern physician cannot practise to anything like the limits set him by modern science without many

accessories, among which are outstanding the laboratory and, for some purposes, the hospital.

THE PUBLIC SETS THE MEDICAL STANDARDS

It is not sufficiently well recognized that the standards of modern practice are set not alone or even chiefly by the experts of the medical profession but very largely by the public that they serve. If we look at the practice of medicine as a commodity that can be bought and sold, the brand of medicine that the old general practitioner had for sale will today find no market. The public demand and insist upon a better article, in considerable measure at least, because they are far better informed and can think far more soundly upon such questions than could their ancestors. This information comes to them daily through the medium of the newspaper, the magazine article and the health columns now syndicated in many newspapers. If the day ever existed when the physicians could impose standards of practice upon a well informed public, that day has gone. Today the standards are largely set by an intelligent public, who are continually becoming better informed and who insist, and have a right to insist, that they have at their disposal as high grade service in the field of medicine as can be obtained with the assistance of modern science.

THE DISTRIBUTION OF PHYSICIANS HAS CHANGED

Alongside and partly because of the change in the basis of medical practice has come a striking change in the distribution of physicians. Continuously, for a period of twenty years, but much more strikingly during the last ten or fifteen years, the smaller towns in the more sparsely settled communities are finding themselves without a physician where they have become accustomed to having one, two or even three. This being a phenomenon that has not before occurred within the memory of man, it has excited a good deal of comment. It has been misunderstood, both in its causes and in its implications. There has gone out from many sources a cry for the return of the old family physician regardless of the fact that if this man, great in his generation, were to return, he would be allowed to starve. There has been thoughtless demand for a change in modern medical education, asking that physicians might be turned out more cheaply in the hope that they would do cheaper work. It might easily happen that they would in fact do cheaper work, but at a staggering cost in human life and human efficiency. Most of the ill-advised comment has come from lack of clear thinking and lack of an appreciation of the underlying facts. The demand is human enough, as human as is the doctrine of the fundamentalist, a demand ages old but hopeless of fulfillment, for it is in fact a demand that the world set back the hands of the clock.

In this change in the distribution of physicians, many factors are involved. An important one is the change of economic conditions, with its trend of population to large centers, with its tendency to spread over the country a network of roads always passable and with the enormously improved means of transportation that have come with the automobile. Another factor is social, and includes improved means and therefore increased demands for education, and an increased unwillingness of people to live alone and isolated when they do not have to. The demand for accessible amusements is irresistible and human.

Only one factor in this change relates itself to the practice of medicine and that is the enormous increase of the science of medicine in proportion to what may be termed the "art." A majority of the scientific facts that have been proved to be applicable to the treatment of disease are of recent origin. Many of them have come to us within the last quarter of a century. As a result, the scientific element in the treatment of disease has increased, in relation to the element that one refers to as the "art," which consists importantly in the ability of the physician to relate himself promptly and effectively to the personality and environment of his patients. This factor in the distribution of physicians is the only one for which the medical profession can in any way be held responsible. But even in this, they must divide that responsibility with two other groups: first, their brethren working in the field of pure science who have made this advance possible, and, second, the great body of public opinion above referred to which demands and will insist that the advances of science be made available in the treatment of human ills. When, therefore, we are inclined to quarrel with the changing distribution of physicians, we must think of it as a very large problem, having many factors to be solved, and which can be solved only by facing it squarely and certainly, not by trying to revert to methods of practice and methods of education that were passably satisfactory at an earlier day.

STANDARDS AND METHODS OF MEDICAL EDUCATION HAVE CHANGED

Parallel with the changes in knowledge of disease, its prevention and control, parallel with the changing economic and social conditions of the country, has come a change in the standards and methods of medical education. Up to a time somewhere near the beginning of this century, most of the medical schools continued to accept students directly from the high school, although even at that time many medical students had had some college work and a small proportion of them were holders of college degrees. At about this time many of the better

schools began to demand one or two years of college work before entering upon the study of medicine, and a few schools, even at that early day, went so far as to demand a bachelor's degree as a prerequisite to medical study. Shortly after the beginning of the century, two years of college work became a standard requirement demanded by most of the better schools. Since that day there has been a steady though rather slow increase in the amount of premedical work required. At the present time, more than half of the students graduating in medicine will be found to hold a bachelor's degree as well as their degree of "Doctor of Medicine." This proportion is steadily increasing, and we may look forward in the not too distant future to the time when the great majority of medical graduates will hold both a bachelor's and a doctor's degree.

A result of this change, which has been evident and much commented upon, has been the increased age at which men enter upon their professional careers, but though this is an obvious result, it is by no means the most important one. Some at least of the critics of the longer course overlook the fact that it has come importantly as a result of a public demand. As has been pointed out above, the public are far more familiar than they used to be with the possibilities of medical practice and have a bowing acquaintance with many of the more important methods. They have come to believe that these methods are essential, both in diagnosis and in treatment, and they are today far more willing to accept the younger practitioner than has been the case in the past. It is a matter of common knowledge in the medical profession that the recent well equipped graduate enters promptly upon a satisfactory practice and that the lean years of waiting have nearly disappeared. This has come about as the result of a public demand for better medical training and an acknowledgment on the part of the public that this training has been given and that the younger men are in fact relatively well equipped to serve the public.

It continues to be true, of course, that the young practitioner is a less sound adviser than his older brethren who have kept abreast of the times, that wisdom increases with practice and that the physician who was well trained and has kept abreast of the times is, when he becomes a senior practitioner, the wisest and soundest servant of the public in this field. It should at all times be remembered, however, that the change in the relation between the younger physicians and the public has come from the public themselves and not from the physicians and that there would be no general satisfaction with a product less well equipped.

THE MEDICAL GRADUATE'S EQUIPMENT TODAY

At this point it will be well perhaps to survey briefly the equipment of the modern graduate of a satisfactory school. He has had at least two years of college training, often more, and during this time he has received fundamental instruction in physics, chemistry and biology. He has, as a rule, acquired some knowledge of a modern language other than his own, and has at least been exposed to some contact with other fields of knowledge. In the medical school he obtained a sound grounding in what may be called the "medical sciences" of anatomy, physiology, bio-chemistry, bacteriology and pathology. Upon this is placed a training in the manifestations of disease that is far better than that given at any earlier period. It is not long since a physician who desired to get the best possible training had to seek foreign countries in order to round out his course. Today it is probably true that medical education in every field is available in this country, and although, of course, there are and will continue to be outstanding scientists all over the world with whom contact is eminently desirable, it is not necessary today to seek such contacts in order to get a wholly satisfactory medical training. I believe it to be true, although it may be open to discussion, that medical education in this country is practically on a par with that obtainable anywhere in the world. This is a tremendous step in advance, and is evidence that the prosperity of this country has been turned to good account in the field of education, where it will perhaps pay as high dividends as anywhere else. The country owes a large debt to those medical educators of the last twenty years whose enthusiasm, foresight and devotion have done much to produce this result.

WHAT THE FUTURE WILL EXPECT OF THE PHYSICIAN

With this survey of the development of present conditions we are now perhaps in a position to make certain predictions as to the probable immediate future of what will occur and what will be desirable in the field of medical education. It is reasonably clear that the broadly educated physician who is to take a part of the place of the family physician of an earlier day must be better trained in and make more use of the knowledge of preventive medicine. A large number of diseases commonly referred to as the "infectious diseases" can be entirely prevented, and with these he must have a profound familiarity. In this phase he is concerned with those operations commonly referred to as the "care of the public health." It is to the advances in this field that we owe much of the decrease of the death rate that has so largely increased our expectancy of life.

But there is another field of what may be referred to as "preventive medicine" with which he must have far greater familiarity than has

been the case in the past. With the falling death rate from infectious disease will come, and already has come, an increase in the importance of so-called degenerative diseases, those conditions affecting chiefly the circulation and the system of elimination that must bear the wear and tear of the battle of life. If, as is the case today, there is to be a very much larger number of people alive between the ages of thirty-five and fifty-five, it follows as certainly as day follows night that the wear and tear on the human machine will become a more important factor in the health of the community. With these conditions—not only in their diagnosis in their early stages, but with their prevention and with their alleviation—the physician of the immediate future must be entirely the superior of his colleague of the recent past.

The increasing complications of modern civilizations have given rise to a larger proportion of what might be called maladjustments, being in fact those individuals who are out of step with the times. These conditions are not properly described as disease and are commonly found in that great category of human ills upon which science has, as yet, failed to put a label, but the victims are nevertheless seriously handicapped and not only a nuisance to themselves but a drag upon the progress of the community. The physician of the future will be expected to have a much more intimate knowledge of those departures from the normal, which constitute mental disease, than has been the case in the past. Some of these diseases, at least, are the products of environment rather than of heredity, and come, therefore, within the purview of the physician rather than of the biologist. Some of them may undoubtedly be cured by early recognition and appropriate management, while others may be so greatly mitigated as to diminish enormously the toll, both financial and spiritual, that they take from the community.

All this will mean that the physician of the future will need a broader concept of his world than he has customarily had in the past and that his training, far from being likely to diminish in length and breadth, must certainly increase in the latter and not improbably in the former.

THE PUBLIC MUST PROTECT THE MEDICAL PROFESSION FROM ILL-TRAINED AND IRRESPONSIBLE INTERLOPERS

After all, it is too little recognized that the practice of medicine is a legally constituted monopoly in which the community has determined that it will sift carefully and hold to high standards those to whom it trusts the care of its health and its future. The fact that this monopoly is legal need not blind us to the fact that it is a monopoly and therefore exposed to all those human prejudices that more or less

inevitably associate themselves with all monopolies. It will require at all times a recognition on the part of the medical profession that they are a highly selected group endowed by the community with very special privileges, and with very special responsibilities to which the public is entitled to hold them. In the same way the public must not lose sight of the fact that it has created this legal monopoly for a very definite purpose and that it must protect the people to whom it gives these monopolistic privileges and upon whom it has placed very definite restrictions from being overwhelmed by an army of ill-trained and irresponsible interlopers who can be held to no standard and who have, in fact, no morals.

THE SELECTION OF PHYSICIANS MUST BE MADE WITH CAUTION AND CARE

Having regard again for the fact that the practice of medicine is a legal monopoly, it will at once be evident that the selection of persons upon whom the state is to set the stamp of its approval must be made with great caution and with great care. It will, of course, be evident that not everyone is capable of becoming a sufficiently highly trained person to take rank with this group, that certain fundamental characteristics are highly desirable if not indeed essential. The physician of the future, as of the past, must be a person of more than ordinary strength of character. He must have, in large degree, fundamental honesty and intellectual integrity. He must have moral stamina and spiritual breadth above the average. He must be physically sound. He must be intellectually capable. In his training he must not only know of the science and of the art of medicine, but he must know much of what used to be called the "humanities." If he is to estimate wisely and appraise soundly questions of economic and social environment, if he is to be helpful in righting maladjustments, he must know something, perchance more than a little, of history, of economics, of philosophy, of sociology, of religion. He will be ill-equipped as a counselor of the community if he knows nothing of the historic and social backgrounds of many of the newcomers in this highly complicated civilization. All of this he must know entirely apart from his fundamental training in the sciences, in the medical sciences, and in the nature and care of disease. I believe that I am on sound ground if I postulate that the physician of the future must be a more highly educated person than any other large group in the community. How else will he support the burden that sound public opinion has placed upon him of utilizing those advances in science that can be made helpful in the prevention or alleviation of disease and in perceiving promptly and advising wisely those who depart, even in small degree, from what is judged to be the normal standards of mankind at that time and in

that environment. He must, in fact, be a superior person who can be produced only from carefully selected and superior material.

It is hopeless to expect to make a good physician out of a bad man and there is little likelihood that a bad physician will be an end-product of the education of a good man. Nowhere will time, thought and money be better spent than in the selection and training of those whom we must trust to keep the human machine fit to live in a world of constantly increasing complexity.

THE POSSIBLE SCOPE OF THE PERIODIC HEALTH EXAMINATION IN THE MODERN HEALTH PROGRAM

EUGENE LYMAN FISK, M.D., Medical Director, Life Extension Institute, Inc.

Before we can view this question in a clear light and, in my judgment, before anyone can even make a periodic health examination in a competent way—and by that I mean in the way most helpful to the individual—certain fundamental principles must be accepted. I am making these statements in positive form for the sake of clarity and precision, and to bring into sharp definition such opposing theses as may be held by others; but I do not assume that I am saying the last word on this subject.

The first principle for which I claim consideration is that we have not reached the millennium; that man is not perfect either in his actions or in his body. The second principle is that no living organism has its life cycle fixed by edict of any kind, but by the varying conditions in the Universe. Third, that the factors in the germ plasm that determine hereditary differences also were not established by edict but arose originally from physical causes of some kind, however persistent they may be at the present time. Fourth, that time has nothing at all to do with the aging of individuals. Fifth, that it is an inevitable corollary from these premises that humanity is in a plastic state, subject to further molding either by natural conditions or so-called artificial conditions brought into action by human science.

Man's various triumphs over gravitation and the interference of other physical agents with his inherited equipment for locomotion establishes a principle that may be applied to every activity of his body, even that of his organs, such as the liver, the pancreas, and the endocrine glands. Human engineering and chemical and physical adjustments of man's cellular equipment are within the range of science quite as much as mechanical engineering—as witness insulin, thyroid, liver extracts, and so on.

I am aware that many will say this is academic talk. They will ask, "Where are your facts and where is your practical mechanism for applying such principles?" I maintain that these postulates must first be admitted, if scientific men are to work with freedom, interest, and energy toward Race Betterment.

Some have naïvely claimed that notwithstanding all the triumphs of medical science and of preventive medicine, the human life cycle has not really been materially lengthened in the historical period, and that even in the recent period beginning with Pasteur, the increase in the

expectation of life is apparent rather than real, speaking from a practical standpoint.

What are the facts?

LIFE IS LENGTHENING

Thirty-seven years have been added to the average lifetime in the past 400 years.[1] Thirteen of these years have been gained in the past 30 years; 7 years since 1910.

It is not true, as has been widely broadcasted, that preventive medicine and personal hygiene have failed to add to the life expectancy of adults.

Since 1789 nearly five years have been added to the average lifetime at age 35, the present expectation being about 33 years. One and one-quarter years have been added at that age since 1910.

It is true that in the past one hundred years practically nothing has been added to the life expectancy of men at age 52 and beyond. This reveals the enormous opportunity of preventive medicine in a neglected field.

The chief gains thus far made are at the ages under 40, but science is slowly working upward to the higher ages.

By no system of mating however eugenically ideal could man hope to inherit a life expectancy beyond 80. There is no known limit to the average lifetime that he might acquire by scientific nurture and control of his tissues.

Man did not inherit the ability to fly, but has acquired it. Man did not inherit the ability to see and talk around the earth, but he has acquired it. He did not inherit a life cycle of 100 years, but he may well acquire it.

Physiological chemistry is in its infancy and may yet be able to supply what the germ plasm has left out and transform what the germ plasm has left in.

I have myself repeatedly called attention to the fact that this increase of thirteen years in the expectation of life at birth during the past thirty years should not be too smugly accepted as a real extension of the lives of those most interested in this question, namely, the middle-aged, producing classes of the country.

HAS SCIENCE REACHED THE LIMIT OF ITS ACCOMPLISHMENT?

Certainly it is a naïve proposition to say that, because the comparatively superficial measures thus far put into effect for Race Betterment can show no important extension of the life cycle beyond age 50, no future extension of the life cycle for that period is to be expected. This is implying that science has reached the limit of its accomplish-

[1] See paper in these Proceedings by Professor Irving Fisher.

ment, that there is nothing more to be discovered, that we are in fact fully applying all of the present resources of science.

Dr. William H. Welch has in no uncertain terms deplored the fact that under present conditions only a comparatively small part of what science knows in the way of health protection and health upbuilding is carried over to the people.

I do not need to weary you with the statistics of the draft, of the Life Extension Institute, or of many other centers where the routine physical examination of apparently healthy people has shown a deplorable condition of physical deficiency. We are not surprised when we read in press dispatches that fifty per cent of the young men examined for service in the French army are now being declined for active duty. This is the record in a war-stricken country. But we know that our own country, comparatively untouched by the War, shows conditions relatively just as bad. This picture of the average modern citizen as a more or less imperfect individual, heading for premature decadence and death, arouses defense reactions among certain types of people. However, we must risk that and tell the truth.

To me the picture is not a depressing one, because it points the way to remedial action and is therefore essentially an optimistic point of view. However, I do not think scientific men have any right to talk about optimism or pessimism. Nevertheless, they may well consider the psychological effect on their leadership if data of this kind are unwisely used and alienate the interest and cooperation of the man on the street whom they wish to influence. In a forum of this kind I feel that we should deal with the facts as we find them, and draw from them such comfort and hope as we may, while at the same time considering the disasters that may follow if we ignore this evidence. I take it that human happiness, the capacity to work and accomplish something worthwhile in the course of our lives, is related, on the average, very closely to health in the broader sense of the word—mental health and physical health.

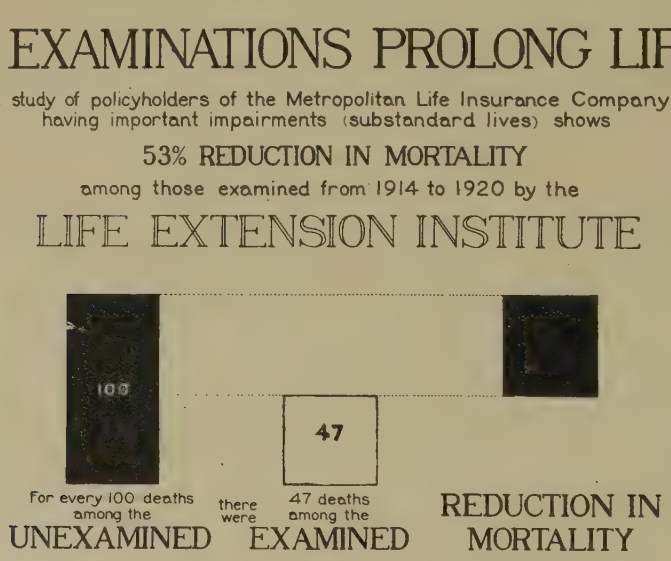
SCIENCE OFFERS ANOTHER LIFE-LENGTHENING MEASURE

If the high development of community hygiene—which we must admit exists—has reached almost the saturation point as far as influencing the human life cycle is concerned, are we through? Is there nothing more that science can do after getting tuberculosis, typhoid fever, and the communicable diseases on the run? Surely no one even superficially acquainted with the situation will admit such a thing.

As Dr. Louis I. Harris, Health Commissioner of New York City, stated recently at a public meeting, "We have passed through the age of sanitation, through the age of personal hygiene, and we have now

reached the age of periodic health examinations." Evidently he views this measure as a fundamental, far-reaching one intended not only to bring immediate benefit to the person examined, but to secure the fullest possible information regarding human conditions, the relationship of impairments one to another as well as to the shortening of the life cycle.

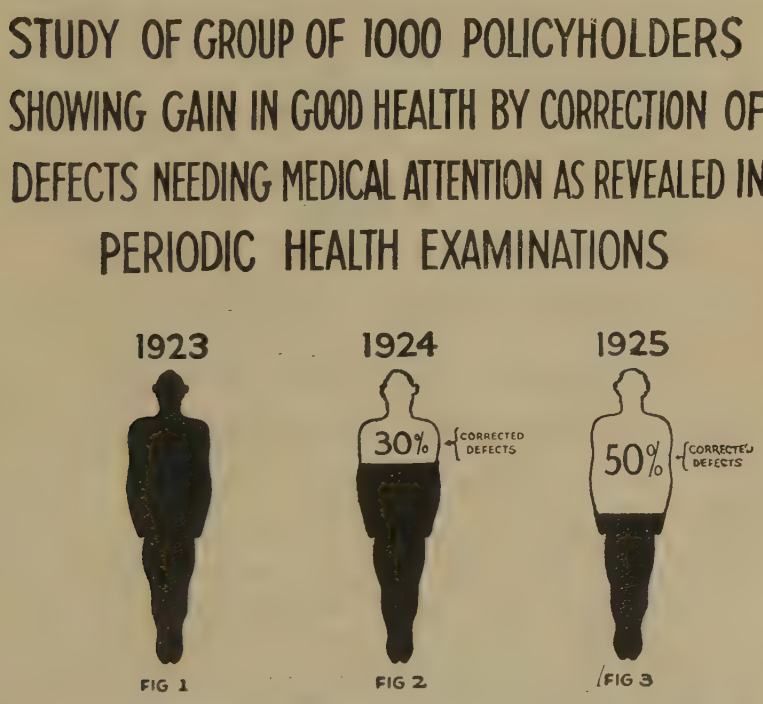
This brings us to a consideration of the periodic health examination in its highest development—not as a mere superficial once-over to check up on the more or less obvious conditions of ill health, but as a measure designed to elicit information regarding the slightest departure from the normal that may potentially affect the remote future of the individual.



DEATH RATE AT MIDDLE AGE REDUCED ONE-HALF

Some fifteen years' experience in the examination of 600,000 people, most of whom received a fundamental health examination not including the full measure of scientific follow-up that is possible and desirable in such cases, has shown the definite value of such a service. I will not go into detail in this matter—the figures appear elsewhere in the literature—more than to say that in the middle-aged group, where it has been so frequently stated that no increase in the expectation of life has been observed as the result of the influence of preventive medicine, there was a reduction in the death rate of more than 50 per cent. The reduction in the death rate for the entire group, including all ages, was 18 to 23 per cent. Also it was found that on the third

examination more than 50 per cent of the impairments noted on the first examination had been cleared up. I mention these things, in passing, as showing the operation of an actual mechanism in producing direct results. The total results are best measured in the death rate.



This work must be regarded as only a first step. This type of examination—which includes the physical examination of each region of the body without the aid of any laboratory or X-ray facilities or other specialized follow-up—is probably the only form of examination at the present time that can be arranged for the mass of the population.

As I have said, this is a first step, however, and as the value of such measures becomes more and more apparent, especially in the business world, I can foresee the organization of facilities that will greatly extend the scope of this work and make available to the average worker—in an industrial plant, for example—the kind of specialized study that his case requires.

The man of average income will in time, I am sure, find centers arising where he may secure as a private matter, apart from any scheme of industrial preventive medicine, the intensive study that he realizes is the soundest economy for him, inasmuch as it will pay dividends in a lengthened work cycle, in an improved efficiency and in an ability to enjoy the proceeds of it.

CLASSIFICATION ACCORDING TO DEGREE OF IMPAIRMENT

100 Policyholders Examined under the Vital Protective Routine

(Average age 43)

Class		Number
1	No physical defects or errors in hygiene	0
2.	Very minor defects requiring attention or observation	0
3.	Minor defects requiring hygienic correction or minor medical surgical or dental attention	12
4.	Moderate defects requiring medical supervision as well as hygienic correction. Impairment influencing longevity	70
5.	Advanced physical impairments requiring systematic medical or surgical attention	15
6.	Serious physical condition requiring immediate medical or surgical attention	3

LIFE EXTENSION INSTITUTE, INC.

It would be a mistake, I think, to withhold information as to the high value of these more or less extensive preclinical surveys simply because they may seem to be out of the reach of the average individual at the present time. Unless we see before us the full capacity of this mechanism, we cannot properly evaluate its lesser functions or be moved to strive for the full protection that science can afford.

MINOR DEFECTS SHOULD BE STUDIED

I am aware that there are some who dispute this thesis, who deprecate these highly-specialized methods of analyzing the apparently well individual, complaining that minor defects discovered have not been fully interpreted as to their significance and that they really require no

attention. I fail to see the logic of such contention. I do not see how the truth is ever going to hurt us if it is wisely handled. The very fact that we do not, for example, know the full significance of some of the variations in an electrocardiogram is all the more reason for taking electrocardiograms and studying these questions.

We do not have to condemn a man to invalidism because of some doubtful variation, but we may well keep him under a little closer observation because of such variation. Internal pathology may be revealed by the X-ray about which there is nothing to do at the present time, but there is no harm in having that information in case of future developments.

As a matter of fact, these intensive surveys put us in a position to give sound warning about many matters that would otherwise be neglected, not only in the way of needed corrective medical treatment, but in some modification of activities.

The fact that a useful and scientific measure of this kind may sometimes be unwisely used is no good reason for condemning the system. Too frequently the misuse of this service is chargeable to the clinician, who is busily concerned with emergency conditions in practice and who shows a lack of tact and understanding in receiving this kind of information and using it for the judicious protection of his patient. His reaction is often that of irritation and annoyance about being bothered with a thing that is of no apparent immediate importance to him.

There is needed a wider comprehension on the part of the medical profession of the value of preventive work carried on, not in an alarmist spirit, but in a hopeful, progressive, and protective spirit.

WHAT ONE ROUTINE TEST REVEALED

This is neither the time nor the place to submit extensive statistics on this question, but a few fundamental facts will suffice to support the thesis I am presenting. Take one phase of a more intensive periodic physical examination than is usually considered when such a measure is talked about—namely, a test for latent syphilis. Recently in our office the Kahn Precipitin Test has been made as a routine regardless of the apparent indication, with the following results:

Total Kahn Tests, November 15 to December 20, 1927—961

Positive Kahns—Wassermann recommended by examiner or counsellor—20 (2%).

Positive Kahns—Wassermann *not* recommended by examiner or counsellor—7 (.7%).

Positive Kahns—Confirmed by Wassermann, without definite signs or history—Wassermanns recommended by counsellors in certain instances—12 (1.2%).

Total: Positive Kahns—27 (2.7%).

This means that when a test for syphilis is not applied in the course of such an examination, there will, on the average, be one or two people out of every one hundred examined who actually have syphilis that escapes recognition in the survey.

THE RESULTS OF GASTRO-INTESTINAL X-RAY EXAMINATION

Take another specialized phase of this work, gastro-intestinal X-ray examination. In a recent study of one hundred cases where such surveys were made—not quite as a matter of routine, because there was some selection, but in a class of individuals who stand midway between the apparently healthy person without symptoms and the frankly clinical case—the following conditions were revealed:

ANALYSIS OF FINDINGS IN 100 GASTRO-INTESTINAL X-RAY SERIES INCLUDING GALL-BLADDER REGION AND COLON AFTER OPAQUE ENEMA

(History Briefly Classified)
(From Unselected Cases in Unlimited Service April-December, 1927)

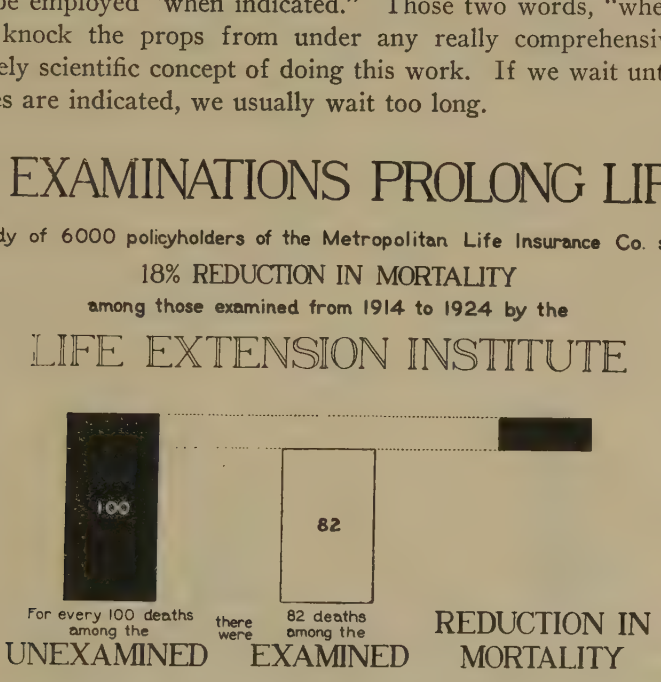
X-RAY FINDINGS	Total Number or Per Cent	Without History of Abdominal Symptoms	With History of Constipation and Excess Gas	With History of General Abdominal Distress	With History of Upper Abdominal Distress
INDICATIVE OF:					
Ptosis of stomach	13		2	2	9
Ptosis of colon	5		3	2	
Stasis	38	2	28	3	5
Incompetent ileocecal valve	37	4	15	8	10
Diverticula or redundant colon	5		4	1	
SUGGESTIVE OF:					
Lesion of stomach	3			2	1
Lesion of duodenum	6			2	4
Adhesions or membranes in region of duodenum	17	1	5	1	10
Adhesions or membranes in region of gall bladder	13	1	3	1	8
Chronic inflammation of appendix	34	2	16	9	7
Pathological change of stomach or duodenum or gall bladder and intestines or appendix	23				
Stasis and inflammation of appendix	22				
Showing no pathological changes	18	1	9	6	2
Almost complete obstruction in hepatic flexure	1	Diarrhea for 4 mos. Loss of 40 lbs. in 4 mos.			

These special phases of the examination do not differ from other phases, in that the highly-specialized study with laboratory, X-ray and other scientific aids is bound to show a similar ratio of incipient defects and, not infrequently, very definite advanced trouble in a fairly high percentage of cases that would otherwise pass undetected even by the most critical physical examination. This applies very forcibly to X-ray studies of the heart and lungs and, contrary to earlier views, also to electrocardiographic studies.

I plead today, therefore, for the full development of this periodic health survey in centers or under conditions where it is possible to provide it.

DON'T WAIT FOR EXAMINATION UNTIL SYMPTOMS "INDICATE" THE NEED

In a recent paper by a highly accomplished clinician who is in the main sound in his views with regard to the value of the periodic health examination, the suggestion is made that such follow-up measures should be employed "when indicated." Those two words, "when indicated," knock the props from under any really comprehensive and completely scientific concept of doing this work. If we wait until such measures are indicated, we usually wait too long.



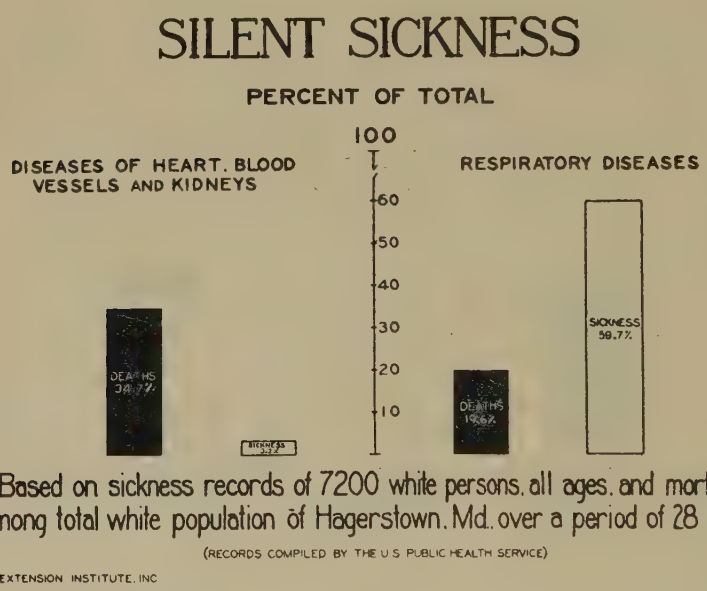
I have not infrequently received word from a person who has been advised to have a Wassermann test or an X-ray study largely as a matter of routine but partly because of slight indications for such measures, that he has seen his doctor, who advised him not to have such a study because he saw no good reason for it. Imagine deterring a man from taking a comparatively simple and inexpensive measure for the protection of his life because there is no "active" indication of the disease that you are trying to prevent! How can a disease be prevented after it has arisen?

I realize that a sense of proportion must be observed in such matters, that the economic condition of the individual must be considered and the highest protection afforded that is consistent with all the other factors presenting. But again, unless we have a true ideal

in this matter, our immediate practical work is likely to be affected in its efficiency and in its ultimate accomplishment.

THE FIRST STEP IN THE CONQUEST OF DISEASE

From time to time the country is aroused by drives against disease —tuberculosis, cancer, diabetes, and against such conditions as overweight. Those engaged in anti-tuberculosis work have long since learned that there is waste motion in attacking any one malady, however important it may be. We have confronting us in the population all of these menacing factors—tuberculosis, cancer, heart disease, kidney trouble, insanity, diabetes, and some like influenza that are not at the present time in the preventable class although in time they must



surely be placed there. If the periodic health examination is carried through to its ultimate expression, it will automatically take care of all of these troubles; that is, it is the elementary first step in combating them.

DISEASE DISCOVERED IN TIME TO ADOPT CURATIVE MEASURES

In a study of 5,000 routine physical examinations (1,500 of women and 3,500 of men), supplemented by urinalysis and, in a few instances, by X-ray examination, the following were discovered:

There were 350 instances, or 7 per cent, of organic heart disease.

There were 47 instances, or 1 per cent, in which the physical findings were serious enough for the physician to make as definite a state-

ment regarding the probability of active tuberculosis as is possible on physical examination only. In addition, 104 instances, or 2 per cent, of pre-tubercular conditions, or suspected tuberculosis, were found. Unfortunately, not all these cases could be followed up by X-ray examination of the lungs, but in those that were, 41 showed X-ray evidence of infection of recent activity.

In examination of the abdomen, 235 instances (4.7 per cent) of tenderness over the appendix were noted. History or findings were definitely suggestive of ulcer of stomach or duodenum in 41 instances.

If, in the routine survey, enlargement of the thyroid gland is found, related findings and history are reviewed, to separate the non-toxic enlargement from the probably toxic. In a total of 420 enlargements (8.4 per cent) there were 347 (6.9 per cent) apparently simple goiters, and in 73 instances (1.5 per cent) toxicity was apparent or suspected.

Findings suggestive of growths are divided into two categories—benign or malignant—although final diagnosis may have to be deferred until further investigation can be made. *There were reported 179 instances* (12 per cent of the number of women) *of apparently benign growths of the uterus* (fibroids, nodules, polyps) *and 4 with strong suspicion of malignancy.* There were 9 instances of breast tumor. New growths in the stomach or intestines were suspected from many histories of indigestion and loss of weight, but they were not all investigated by X-ray. With this aid in only a few cases, there were diagnoses of new growths in 12 instances, and 4 of advanced carcinoma.

Apparently benign growths in other parts of the body were reported in 149 cases (3 per cent), and malignancy was suspected in three cases of skin changes.

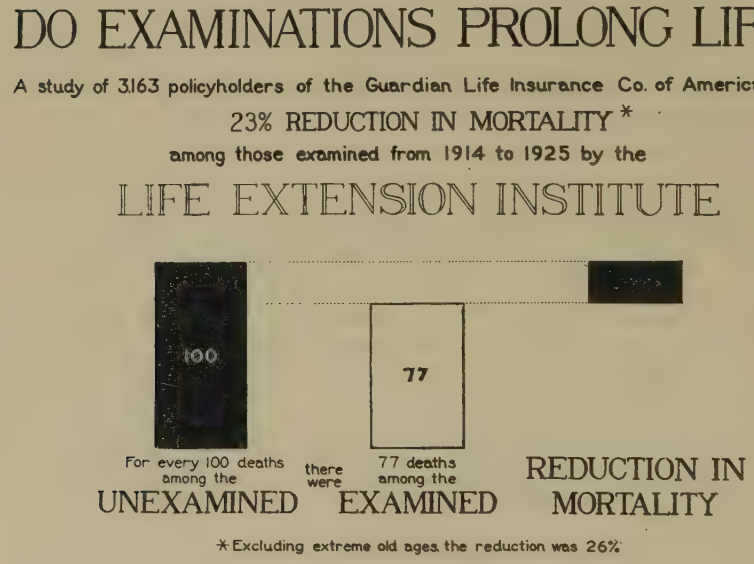
I do not say that there are not other organized special measures, such as heart clinics, mental clinics, and the activities of the private practitioner, in dealing with these situations when they are revealed; but I do claim that if it were the custom of every man, woman, and child to have a periodic examination once a year—in some classes, every six months—we could get further in a decade in the conquest of these maladies than we could in a hundred years by separated activities directed to the early care of active cases.

A PHYSICAL EXAMINATION ON YOUR BIRTHDAY

This is now the policy of the National Tuberculosis Association. "A physical examination by the family physician on one's birthday" is the present chief slogan of that organization. It ought to be the chief slogan of the cancer drives and the drives against heart disease and so-called degenerative troubles.

I have been talking a good deal about disease and I now want to talk about health. Apart from the detection of incipient disease, such a service in its ultimate development should take into account the insufficiencies of the organism—the possibilities of better human nurture. Beginning early in life, the physical defects should be trained out as far as possible.

At present I feel that those with true scientific balance must stand midway between the eugenist and the behaviorist. There is no use in telling a man he must have better grandparents. It cannot be done. But he may secure for himself and for his children the wisest scientific



counsel on how to compensate for such hereditary defects as he may show. And as time goes on, more care in mating, to exclude the most flagrant errors in that respect, may produce good results.

THE LARGEST OPPORTUNITY IS IN THE FIELD OF EUTHENICS

Personally, however, I view the largest opportunity in the field of euthenics rather than in the field of eugenics. Even though the longest-lived people in the world were mated together, there would be a definite limit to the possible extension of the human life cycle. No one knows how far the human life cycle might be extended as the result of science working on the individual to supply what heredity may have left out and to add power far beyond anything that heredity could possibly supply.

I am aware that this subject cannot be pursued very far without raising problems that are at the present time insoluble; but I see nothing unscientific and nothing inherently improbable in the prediction that barring some disaster to our civilization that will submerge it and compel the human race to begin over again, we may regard humanity, as it now exists, as only nibbling at life and far below an attainable condition of longevity and capacity for enjoying life.

It is to my mind a huge joke to see a "free thinker" adopt the thesis that there can be no extension of human life or very much added to its power. The unconscious acceptance of supernaturalism by such writers is one of those refreshing things that amuse us and lighten our labors as we do the day's work in endeavoring to push these problems further back.

The aim of such a campaign is not to take the joy out of life, but to take the misery out of life. There is no joy in rheumatism, Bright's disease, diabetes, tuberculosis, cancer, or heart disease. The purpose is not merely to prevent these diseases, but to effect a transformation of human life into something happier, more powerful, and more abundantly satisfying.

NEW CANCER DIAGNOSIS

Dr. George N. Papanicolaou, Cornell University Medical College.

I will only give a report of some work of mine which may have some bearing on the diagnosis of certain malignant tumors, especially those of the female genital tract.

This work was started about two and one-half years ago in the spring of 1925, first in the clinic of Cornell Medical College, then in the Women's Hospital in New York City. First we selected a number of normal women, and we took vaginal smears every day. The technique was very simple. We used a small pipette and took a little fluid from the vagina every day. Our intention was to find out if there was any definite morphological change in the vagina and the vaginal smear that would reveal some of the more important changes that occur in the ovaries and in the uterus.

As you probably know, this method has been applied very successfully in other mammals, especially in the rodents, with really surprising results. It has been possible to diagnose or to recognize certain changes in the ovaries and in the uterus. For instance, the time of ovalescence in the ovary may be ascertained by simply taking a little fluid from the vagina and examining it under the microscope. It would be ideal if we could apply this same simple method in human physiology and if we could, by the story of the vaginal smear, predict the condition of the ovary or of the uterus at a certain definite time. Unfortunately, the organ in the woman is a little more complex than it is in most other mammals, especially in the rodent; some of the typical changes in stages that occur in the organs that allow the recognition of corresponding changes in the ovary are not easily expressed. For instance, the beautiful leukocytic reaction in the rodents that characterizes certain stages and permits the diagnosis of ovarian and uterine changes are not so well expressed in the human. For this reason most investigators who had studied this problem did not report very satisfactory results. I am sorry I cannot report to you about these findings today because of limiting my presentation to the possible diagnosing of certain conditions, especially malignancy. Another factor that makes this work a little more difficult in the human is the tremendous variety of bacterial forms that are present in the human vagina; the number is much higher than that of the bacterial flora in other mammals. In fact, in every case you may see very different flora, and this may be associated with various morphological conditions.

CHANGES THAT OCCUR IN MALIGNANCY

For this reason I found myself compelled to undertake some pathological work, because otherwise it was impossible to know what was normal and what was pathological and how far these various bacteriological forms were pathological changes. So I studied smears from various pathological cases, including all kinds of infections—staphylo-

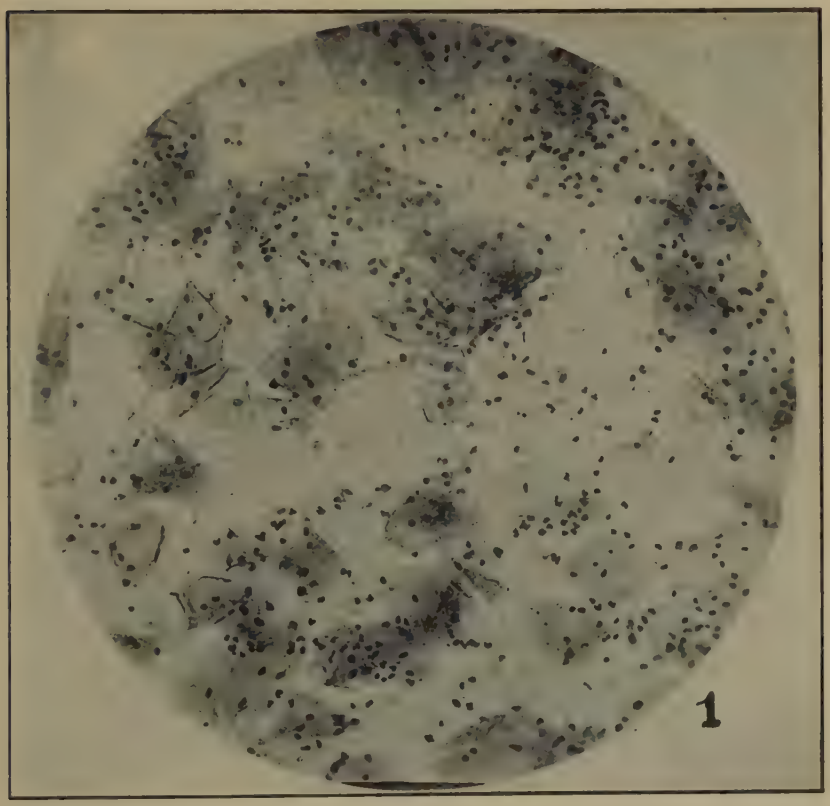


FIG. 1. Photograph of a normal human vaginal smear, showing squamous vaginal cells and a number of leucocytes.

NOTE.—Magnification of Figures 1 and 2—about 120 times.

coccus, streptococcus, gonococcus, various inflammatory conditions of the vagina, of the uterus, of the tubes, cases of tubercle abscesses, cases of ovarian cysts and other conditions of the ovaries, and also cases of pregnancy and of tubal pregnancy, of abortions and finally cases of benign and malignant tumor. One striking fact was found in all cases of benign tumors, or other pathological conditions, and of the normal The changes that occurred were all a little different from what happens in cases of malignant tumor.

For instance, in a case of benign tumor everything you find in a vaginal smear is more or less normal. The cells look like the cells found in normal smears. Thus it is rather hard to diagnose a benign tumor of the uterus, a myoma or a fibroid. It may be very large but it is hard to diagnose it as such and say, for instance, this is a case of a fibroma or a myoma of the uterus. You may have certain indica-

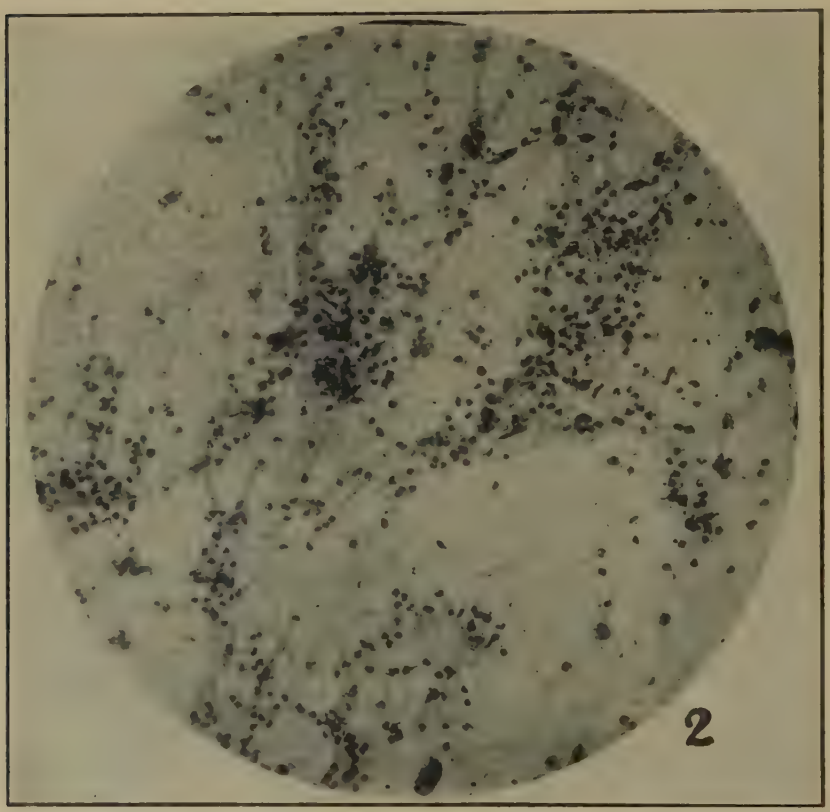


FIG. 2. Photograph of a human vaginal smear taken from a case of cancer of the cervix. It shows an increased leuco-monocytic reaction and a decrease in the number of cells. The leucocytes and monocytes are arranged in heavy dark groups. There are also many erythrocytes present in this smear.

tions, however, of the presence of a hyperplastic condition in the uterus and some indications of hyperplasia of the endometrium which may allow you to suspect the presence of a benign tumor, especially if you eliminate other possibilities. In contrast to this, in all the cases, or rather well expressed cases, of malignant tumors, there are some definite and typical characteristic changes. If we take, for instance, as an example, one case of carcinoma of the cervix, which is the most common type, in the smear you may find some conscious cells. When

these conscious cells are present—and they are present in most of the cases—they are easily recognized, much easier than in sections, because in sections the cells are crowded one against the other and you do not see the quality of the cell; whereas in smears the cells are isolated and the morphological changes that occur in these cells are really so different but the recognition of the cells is not so difficult. It is not an

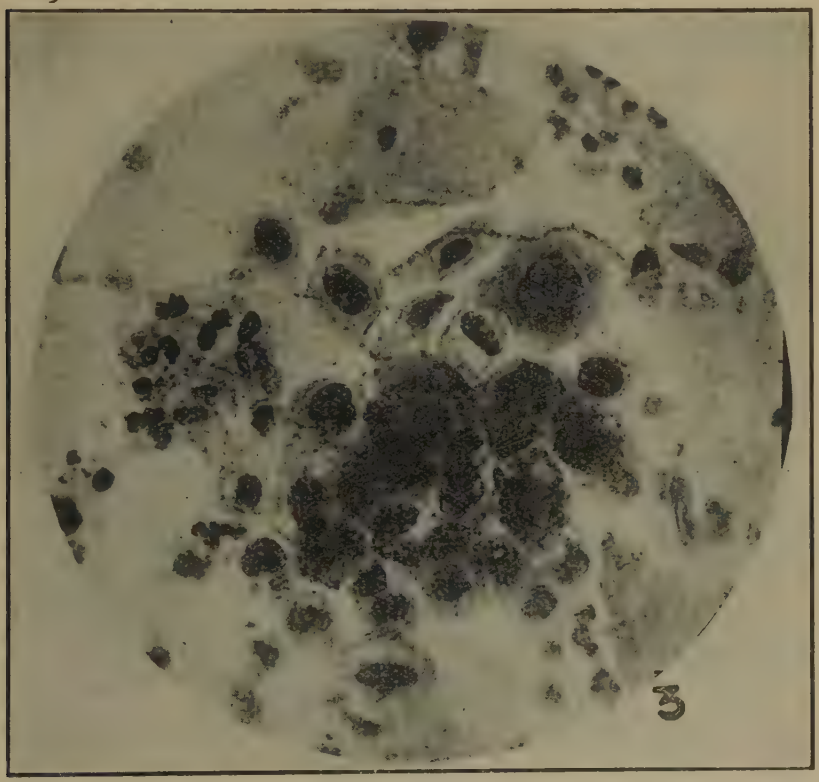


FIG. 3. Group of monocytes, showing enlargement and hyperchromatic condition of nuclei (early cancerous modification). The smear shows also one normal squamous vaginal cell, several leucocytes and erythrocytes and one leucocytic group.

NOTE.—Figures 3, 4, 5, and 6 are photographs of human vaginal smears taken from cases of cancer of the cervix. Magnification about 300 times.

exaggeration to say that certain cases of carcinoma of the cervix may be diagnosed by the presence of only one of these cells.

CHARACTERISTIC CELL CHANGES

The changes of the cells are mainly an abnormal growth and the development of the nucleus of the cell. The nucleus becomes very large, out of proportion to the cell, and becomes very dark and dense, and often it shows fragmentation, it breaks up in pieces. This is a very common occurrence. Besides the plasm it shows vacuoles very often.

Outside of the conscious cells you have a large number of leukocytes, lymphocytes and plasms. We find these elements in their pathological conditions, especially the leukocytes, which are present almost constantly in the vagina because they perform a very important rôle. The phagocyte will clean up the vagina constantly by destroying all the superfluous material. For this reason you find these leukocytes, mono-

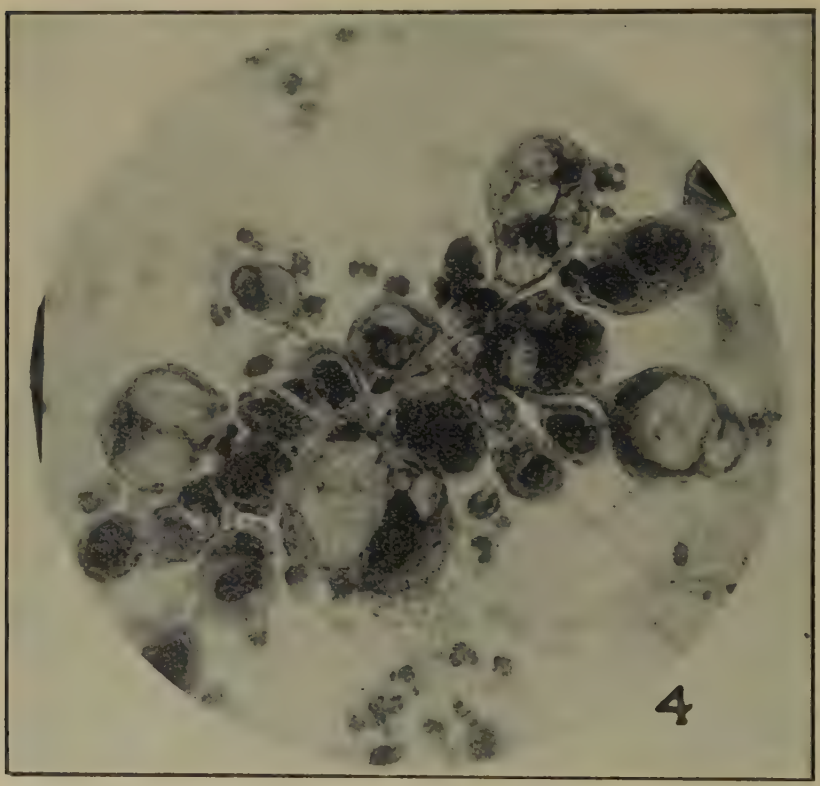


Fig. 4. Another group of monocytes showing cancerous modification of the nuclei and also large empty vacuoles (increased phagocytic activity).

clasts, constantly in the vagina. In cases of cancer, however, they are in very large number and at times the vaginal smear looks almost entirely leukomonocytic, consisting almost entirely of leukocytes and monocytes. Also they often form large and heavy groups of themselves. This is due to the fact that they have to destroy cells or groups of cells which are larger than they are. Then they attack them in groups in a cooperative way; they form groups with some half digested cells in the center and some monocytes and leukocytes around them. These groups are common in cancer cases, but the monocytes are more characteristic.

The main interest, however, of this phagocytic reaction is that there is a difference between the reaction of these leukocytes in cases of benign tumors and in cases of malignant tumors. In the case of the benign tumor, for instance, the phagocytes perform their function undisturbed in the normal way, whereas in the cases of malignant tumors they are affected evidently by something present in the cancer

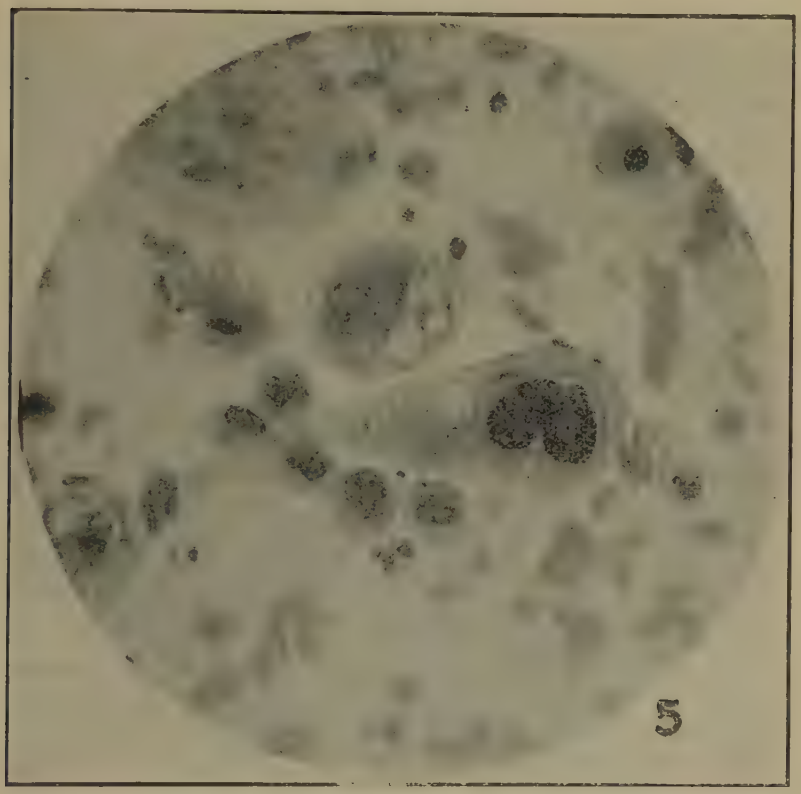


FIG. 5. One cancerous cell with a large, hyperchromatic and partly fragmented nucleus and with a vacuole in its cytoplasm. The smear also contains several monocytes, many erythrocytes and few leucocytes. The monocytes in this figure are not so badly affected. One is large and shows a number of vacuoles.

and show some definite morphological changes that are comparable to the changes that occur in the conscious cells.

This happens especially in the mononuclear. The mononuclears act in a specific way to the cancerous toxins. This specific morphological reaction of the mononuclears has practical value and also theoretical importance in that it makes possible the diagnosis of cancer morphologically in cases where cancer cells are not present, and also because it gives us a good indicator to study further and to analyze better the cancer problem.

Summarizing the points of importance:

First: We have a new diagnostic method for certain malignant tumors, especially of the female genital tract.

Second: The methods and the technique used are very simple ones, and can easily be applied in every case.

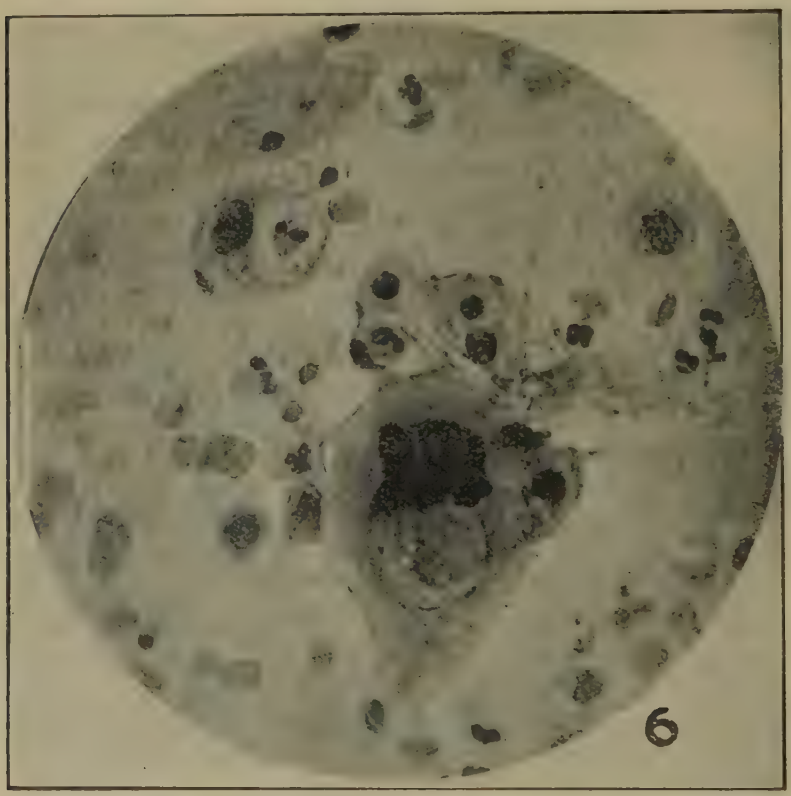


FIG. 6. Another cancerous cell with large, hyperchromatic and fragmented nucleus and with a large vacuole in its cytoplasm. Many erythrocytes are present in this smear, few leucocytes and several monocytes, which are more affected than the ones present in Fig. 5. Some of these monocytes are phagocyting dead leucocytes.

Third: The recognition of malignancy is based not only on the presence of malignant cells but also on the reaction of the organism itself.

Fourth: We have a better understanding of the situation in a cancer case, and we may have some help in analyzing the cancer problem in the future. In fact, I think this work will be carried a little further, and that analogous methods may be applied in the recognition of cancers in other organs. I think that some such method can be and will be developed in the future.

WHAT UROLOGY HAS DONE AND CAN DO IN LENGTHENING LIFE

Oswald Swinney Lowsley, A.B., M.D., F.A.C.S., Director Department of Urology (James Buchanan Brady Foundation) of the New York Hospital

The first-class modern urological surgeon differs from the first-class general surgeon in two respects: First, he possesses special instruments of precision and knows how to use them; second, he deals altogether with cases suffering from genito-urinary troubles, and therefore rapidly piles up experience with this type of case.

The day has long since gone by when the urologist was a man who failed at other branches of medicine and drifted into our special branch. The young man who enters this field today must be a graduate from a class A medical college, and have at least two years of hospital experience in general medicine and surgery before he is allowed to begin our course of three years of special training in urology.

The perfection of the cystoscope, with all of its modifications, and of other instruments of precision, has brought the diseases of the genito-urinary tracts within the realm of those conditions that can be accurately diagnosed. In these times the urologist makes practically all of his diagnoses at the cystoscopic table and in the laboratory, so that an exploratory operation is almost an unknown thing. Until recently, children were excluded from this otherwise general rule, but the recently perfected baby cystoscope of Butterfield permits of the proper investigation of any child of either sex and of any age. This is a great advance in our armamentarium, as formerly it was impossible for such cases properly to be investigated.

THE GONOCOCCUS DEVASTATING TO THE GENITO-URINARY TRACT

The commonest and most devastating infective agent of the genito-urinary tract is, and always has been, the gonococcus. This disease is so common that practically every man and woman who holds promiscuous sexual intercourse becomes infected sooner or later. It is rarely fatal, but it has the elements of great danger. Those ignorant people who refer to this disease as "no worse than a bad cold" need only see some of the mutilating effects of this dire disease to change their opinions radically. Only last year, a splendid young doctor contracted the disease from his fiancée, neglected treatment, and developed a prostatic abscess, which had to be opened. Three days after the operation he developed a septicaemia and his life was saved only after weeks of intensive work on the part of a great many people and by the aid of multiple transfusions.

GONORRHEA AND SYPHILIS PREVENTABLE

The excellent work done by the urological division in the A. E. F. during the Great War has proved conclusively that both gonorrhea and syphilis are preventable diseases, and that the proper methods to be employed in this prevention should be a part of every child's education when he or she reaches the age of discretion. The time for keeping such important information under cover should be past. It is not fair for our boys and girls to acquire sex information from servants and other ignorant or vicious persons. They are entitled to all information important to their good health through the proper educational channels.

The very fact that less than 2 per cent of the soldiers exposed to venereal infection in France developed any disease if they took prophylactic measures within six hours after exposure proves that the incidence of venereal disease may be reduced to the minimum if prophylaxis is general.

And if such were the case, gonorrhea and syphilis would soon disappear. Unfortunately, the civilian is particularly callous to these measures, and these two diseases will probably always be in our midst until the adoption of education of the public in such matters becomes general. This time will probably be long delayed.

SATISFACTORY RECOVERY UNDER COMPETENT MEDICAL CARE

The treatment of gonorrhea and syphilis is much more intelligently applied than before, and those patients who submit to competent medical care usually recover satisfactorily. There is a great tendency on the part of the patients to disregard treatment as soon as the active signs of the disease disappear. This is particularly true of the syphilitic, and particularly dangerous. Syphilis is a disease which, if gotten early, may be entirely cured by a thorough course of treatment, but which has most horrible sequelae if not thoroughly treated.

SURGICAL TREATMENT IN COMPLICATIONS

Complications of gonorrhea are prone to cause sterility. The prostate frequently becomes involved and may be so disordered that the prostatic fluid will not be sufficiently active to stimulate spermatozoa to a satisfactory passage into the uterus of the female. Ordinarily this condition is remedied by an efficient course of treatment.

Bilateral epididymitis is, however, a condition that demands operative intervention. An operation has been devised that permits the vas deferens to be attached to the rete testis, thus short-circuiting the stream of spermatozoa and leaving the blocked off epididymitis in situ. A moderate degree of success has followed this procedure.

TUBERCULOSIS

Tuberculosis frequently attacks the organs of the genito-urinary tract. It may effect any or all of them. The most frequent portals of entry are (1) the epididymis and (2) the kidney. Very often the kidney becomes involved after the epididymis, the general opinion being that the bacilli are carried by the lymphatics from the affected epididymis to the lymph glands at the hilus of the kidney and the latter organ becomes involved by extension. Evidently the organisms are blood bourne and the original focus whence they arise may not be demonstrable.

Any degree of tuberculosis of the epididymis should be removed as soon as the diagnosis is made. Palliative treatment such as X-ray, Alpine light, infra-red ray and other methods should give way to surgery as far as the epididymis is concerned. The operation is done under regional anesthesia and is practically harmless.

RENAL TUBERCULOSIS

It was formerly our practice to remove a kidney if tubercle bacilli were found consistently by microscopic examination or the guinea pig test. Now we do not remove a kidney unless its function is diminished and unless the pyelogram shows excavation. The mere finding of tubercle bacilli is not sufficient evidence for removal in itself; it is merely a link in the chain of evidence.

SPECTACULAR RESULTS IN CLINIC FOR INFECTED KIDNEY CASES

In former years we felt that the patient was amply treated if we removed a tuberculous organ such as the kidney, and to our chagrin often found the patient returning with the other side hopelessly infected and beyond repair. We now consider that in removing a tuberculous organ we have merely arrested the disease and the patient is not cured at all. Our work has just begun, in fact. All cases on our service who have been operated upon, or who have slight or marked bilateral renal disease, or who have tubercle bacilli present in the urine from one side without marked diminution in function of that side, are treated in a special clinic. Such cases are given instructions about diet, fresh air and other personal hygienic matters. They are seen at regular intervals, weighed, temperature taken and other important facts noted. Alpine lights, injections of tuberculin, and other suitable measures are carried out by a well trained corps of doctors and nurses.

The results of this clinic are spectacular in the extreme, and are among the most important things that our department has done for the community. I shall cite one case as an example:

A young Italian woman aged 32 years, the mother of two healthy children, reported to our clinic about one and a half years ago suffer-

ing from frequent and painful urination, loss of weight and general debility. It was necessary for her to pass her urine every 15 or 20 minutes day and night. Cystoscopic examination with catheterization of the ureters revealed the fact that she was suffering from extensive tuberculosis of both kidneys and of the bladder. She was put on a hygienic regimen, fresh air, forced feeding, injections of old tuberculin in increasing doses, and application of the Alpine light. The result has been that she has improved remarkably. She now passes her urine every three hours and sometimes goes as long as five hours at night. She has gained 31 pounds in weight, and is able to do her housework and to attend to all of her duties.

Our tendency is to avoid nephrectomy wherever possible, and our actions are justified by the excellent results obtained by non-operative methods in cases of renal infection other than tuberculosis if the kidney retains any functionating ability. By dilating strictured ureters and irrigating infected kidney pelves, by applying belts with pads to elevate ptosed kidneys, we are frequently able to relieve pain, improve drainage and get rid of infection. We now try to relieve nearly all cases of hydronephrosis by the methods mentioned above, and the results warrant a continuation of this procedure.

REGIONAL ANESTHESIA

The operation of nephrectomy is performed in our clinic under regional anesthesia. This is a wonderful saving to the patient, and has considerably reduced the mortality. The method used is as follows: Upon arrival the patient is taken directly to the anesthetic room. A special nurse is assigned to be present until the surgeon is ready to proceed. All evidence of haste, flurry, or active preparation are shut out.

When all is ready for the administration of the anesthesia, the patient sits on the table with feet on a support. The hands rest on the knees or on the shoulders of an attendant who sits in front of the patient. The back is bent slightly forward and the head lowered. This position throws the bony parts concerned into most prominence, and is maintained while the first part of the anesthesia is given. It may also be administered with the patient lying on the opposite side.

METHOD OF ADMINISTRATION

Starting at a point a little below the 12th costo-vertebral angle and about 2 cm. from the midline, a long wheal is raised by the injection of 1 per cent procain. This infiltration extends from the original point to the level of the 8th rib. A point of the spine opposite the 7th dorsal vertebra and 2 cm. from the midline is selected. A carefully tested needle is inserted until it strikes the angle formed by the lamella on

that side and the transverse process. It is then pushed over the edge of the bone and the point deflected inward, the needle being again inserted for a distance of about 1 cm. This brings the point of the needle into the area occupied by the merging nerve roots. Suction is put upon the syringe to make sure that the point of the needle is not in a blood vessel and then 2 or 3 c. c. of 1 per cent procain solution are injected into the region.

This is repeated at the 9th, 10th, 11th and 12th dorsal vertebrae. The angle formed by the 12th rib and the vertebral column is filled quite thoroughly, both superficially and deeply, with the solution, all injections taking their origin from the original wheal. The patient is then placed on the opposite side in a comfortable lying position.

Injections are made into the skin, subcutaneous and muscular tissues of the entire loin with ½ per cent procain. All of these injections take their origin in the preliminary wheal, so that the only pain the patient feels is one needle prick at the beginning of the infiltration.

It is very important to avoid pain in the administration of the anesthesia because the average patient will be much more cooperative if this is successfully given. It is hard to convince the patient that no pain will result from a cutting operation if the administration of the procain is particularly uncomfortable. It has been our custom not to give more than 150 c. c. of 1 per cent procain (1.5 gm.) or its equivalent to the average-sized man (1 gram per 100 pounds of body weight).

It has always been possible for us to proceed as soon after the completion of the injection as it was possible to get the patient in position and properly prepared and draped.

When we approach the intervertebral foramen, care must be used not to exercise too much pressure, as it is at this point that toxic symptoms with absorption of the drug may occur. Neither is it a necessity to have the fluid penetrate the foramen or reach the nerves, as pressure at the sill of the foramen seems sufficient to produce the desired anesthesia. Raising and lowering the needle alternately at the sill of the intervertebral foramen assures a better distribution of the anesthetic, and is important. The vicinity of the 12th nerve, lying as it does below the rib and having a tendency to spread, should receive a little more anesthesia than the nerves above.

The successful carrying out of this technique should give us a complete anesthesia of the posterior lateral and enough of the anterior abdominal wall to allow any of the modern kidney incisions to be made. It is rarely possible to obtain a peritoneal and abdominal anesthesia as well.

It may be well to repeat that the anesthetized areas should be tested out before we start on an operation. It is also advisable not to ask the

patient if he feels pain. If it is present, he will promptly communicate the fact to you. If he is asked regarding sensation, he is prone to become hypersensitive. An eminently wise precaution that should not be overlooked is the screening off of the field of operation from the patient's view. The well nurtured patient often expects to experience pain, and this being so, one finds that painful sensations are often absent when the manipulations of the surgeon are invisible to the patient. The presence of a physician or a well trained nurse to keep the patient's mind diverted from the operative field is a most valuable asset in this technique, as in other local or regional procedures.

ADVANTAGES OF THE METHOD

The method that we have described seems to have several advantages over the older ones. In fat or heavily-muscled individuals, it is extremely difficult to locate the rib at the point usually recommended, on account of the fact that there is a tremendous amount of tissue between it and the skin. By the method described above, however, it is always possible to locate the angle formed by the transverse process and the lamella of the vertebrae, and that allows the injection to be made in the proper place in all the cases.

It is considered particularly important to conduct the entire injection with only one prick of the needle. The patient immediately feels that he will be carried through without pain, and the fact that the injection is practically painless serves as a tremendous physiological boost.

TECHNIC OF THE OPERATION

Experience teaches us that careful sharp dissection will not cause discomfort, while any rough treatment is liable to be accompanied by pain. Therefore the scalpel is used freely, in separating muscle bundles even. The incision is made larger than the ordinary case in order to render heavy retraction by assistants unnecessary. Satisfactory retraction is entirely possible, but sudden movements of any sort are liable to cause complaint.

The incision is invariably a painless procedure. The separation of the kidney from its surrounding adhesions, however, requires special treatment. We have learned that if one avoids any manipulation upon the front or peritoneal surface until the remainder of the organ has been freed, there will be less pain connected with this part of the operation.

The ureter is usually isolated without much difficulty or pain. Most writers on the subject lay great stress upon the amount of pain caused by clamping the pedicle. It is our experience that this act seldom results in pain. Should pain follow, it is easily controlled by injecting some solution into the tissues forming the pedicle.

REGIONAL ANESTHESIA IN OPERATIONS AN OUTSTANDING ADVANCE

The outstanding surgical advance that has been made recently has been the adoption of regional anesthesia for operations upon many organs particularly those of the genito-urinary tract. Any and all of these organs may be thoroughly anesthetized for operative purposes. Among the beneficial results of such anesthesia are the following:

The patient is not dehydrated as he may take fluids up to, during and immediately after operations upon the organs of the urinary tract.

There is less loss of blood because the blood pressure is not elevated as it is with all types of general anesthesia.

The anesthesia continues for 6 to 8 hours after operation, which is an important consideration in view of the fact that it may eliminate pain from the post-operative picture, thus doing away with one of the elements that cause shock.

Particular mention should be made of prostatectomy under regional anesthesia because in our operations upon that structure we have obtained our very best results. Some years ago we compared the results of our last 100 cases of prostatectomy done by the former methods with the first 100 performed under the new technique.

COMPARISON OF THE LAST ONE HUNDRED CASES OPERATED UPON UNDER GENERAL ANESTHESIA WITH THE FIRST ONE HUNDRED CASES OPERATED UPON UNDER REGIONAL ANESTHESIA

Oldest Patient	Youngest Patient	Average Age	Longest Hospital Stay	Shortest Hospital Stay	Average	Serious Bleeding	Shock	Anti-Shock Measures Necessary	Other Complications	Deaths
General Anesthesia										
85	30	64.65⅕	90 days	10 days	33 days	14	23	14	23	14
Regional Anesthesia										
82	49	65.25⅕	56 days	10 days	22.7 days	2	4	2	12	3

MORE MALIGNANCY THAN IN FORMER YEARS

The question of malignancy is one which is increasing in importance. We are certainly seeing more malignancy than we did in former years. We are not sure whether this is due to the fact that there is more malignancy, or whether the medical profession is more skillful in diagnosing it; probably the former.

As one surveys the situation he is thoroughly convinced that our present methods of dealing with malignancy are entirely inadequate. In fact the ground has barely been scratched. There are many analagous points between plant and animal malignancy as pointed out by

the late Professor Smith of the Department of Agriculture in Washington, D. C. The fact that he could produce plant cancer apparently at will, by transplanting certain bacteria, leads many of us to believe that the cancer problem may ultimately be solved by some biological means, and that our present treatment may be relegated to the historical past.

However, the general principle that should guide us with our present knowledge would seem to be to excise cancer whenever it exists in an accessible place.

SOME APPARENTLY PERMANENT CURES

It occasionally happens that a complete resection results in a permanent cure. We have several cases that have apparently been cured by operation. One case of particular interest is a man upon whom I operated in 1917. The papillary carcinoma located in the right ureteral orifice was resected with a wide cuff of normal bladder wall and a part of the ureter. The ureter was then transplanted to the upper part of the vesical fundus. He then received two applications of radium. He has remained well, and when seen five months ago was entirely well, there being no evidence of recurrence.

There have been five other apparent cures of bladder tumors in our series. One of these was operated upon six years ago, another five years, two three years ago and one two years ago.

A complete resection of the penis with carcinoma, performed eleven years ago, is still well, there being no evidence of recurrence.

We have several cases of tumor of the kidney that were cured by nephrectomy.

Never have we seen a case of carcinoma of the prostate early enough to extirpate it by operative means. The reason for this is that examination of the prostate is not a part of the physical examination as practised by the general practitioner. We feel, very strongly, that this examination should always be included in every physical examination made upon every male patient over twenty years of age for any ailment whatever.

STONE

Urinary calculi are very serious, and when they become large must be removed by operative intervention. Stone in the ureter is best removed by dilating the ureter below the stone and allowing the foreign body to pass out. This is particularly important in stone in the ureter because this viscus is very inaccessible, and when opened we have the problem of possible stricture developing at the site of the incision with all of its attendant evils.

Recurrent calculi are frequent in our experience, and measures to prevent the formation of stone are most important. We have been able

to cause a cessation of the formation of calculi in the kidneys of several chronic alkaline stone developers by changing the reaction of the urine from alkaline to acid. This must be done with care, however, as the possibility of the patient developing acidosis is always present and must be carefully guarded against.

COMPLETE INCONTINENCE OF URINE CORRECTED

Plastic operations upon persons suffering from complete incontinence of urine are successful by the methods recently described by the author. This operative intervention is far more important than merely prolonging the lives and happiness of the persons concerned. It makes courtship and matrimony possible for these individuals who were previously isolated from all social activities, and reproduction may result in such cases.

LIVES SAVED BY USE OF PYELOGRAPHY

The recognition by means of pyelography of congenital malformations of the kidney, such as fused kidney, horseshoe kidney, polycystic kidney or other conditions, make intelligent work on the part of the surgeon so much more accurate that a great saving of life results.

CONCLUSIONS

(a) In conclusion, one is impressed with the fact that urologists have demonstrated beyond a shadow of doubt that the terrible devastating diseases, gonorrhea and syphilis, are absolutely preventable, and an extensive public education of prophylactic measures is recommended. Our surgical measures have been successful in rendering men, crippled by the effects of gonorrheal epididymitis, fertile by the operation epididymo-nosostomy, which makes possible the flow of spermatozoa from the testicle to the urethra in spite of the fact that the epididymis is scarred beyond repair.

(b) It has been learned that early incision of tuberculous organs such as the epididymis will prevent a spread of the disease.

(c) By our modern methods of diagnosis, it has been possible to determine the exact character of early lesions of the genital and urinary tracts. This allows early excision in cases requiring it, such as tuberculosis and cancer, and in many other instances such as stone and stricture of the ureter, mild infections of the kidney, etc. It is possible to administer appropriate treatment and save the kidney. The measures employed undoubtedly prolong many lives and give comfort and happiness to thousands.

(d) The most important measure by which we have added to the span of life in recent years has been the adoption of regional anesthesia for operations upon patients suffering from diseases of the genito-urinary organs. It is particularly appropriate for operations upon the

prostate gland, and in our opinion its use should be general. Not only is our mortality record much improved, and are complications fewer, but the patients leave the hospital earlier and in better condition than was formerly the case when anesthesia was used.

(e) The prevention of stone formation has been possible in some cases by merely changing the chemical reaction of the urine.

(f) Cancer seems to be on the increase. This dire enemy of the human race should be totally excised as soon as discovered if conditions permit. Certain carcinomata respond to radiation, others to operation and some do not respond at all. Our procedure should be to treat this disease by every means at our disposal and to encourage all types of researches in the field. One cannot help but be impressed by the similarity between plant and animal cancer, as pointed out by the late Professor Smith of Washington, D. C. Perhaps the cure for cancer may be discovered by a biologist.

(g) Congenital and acquired incontinence of urine is fortunately rare. When present it totally unfits the sufferer for all social life. Therefore these sufferers who can be cured by operative intervention are relieved from their isolation and may produce their kind.

(h) One of our greatest successes has been in the care of those patients suffering from tuberculosis of the urinary tract. Our former practice of disregarding inoperable and post-operative cases of tuberculosis has been succeeded by a carefully regulated clinic, which has adopted methods of hygienic regulation, application of healing therapy, consisting of injection of tuberculin, application of the Alpine and Kromayer lights and other up-to-date methods. The results have been gratifying in the extreme.

REFERENCES

1. Sellheim, H. Die Herabzetzung der Empfindlichkeit der Bauchdecken und das Peritoneum durch perineural le injection anesthesiender los unger an die stamme der newen intercostales des subcostalis des ihchypogosticus und desilio-inguinalis. Verpandle d deutsche Gesellschaft c Gynak 1905, pp. 176-179.
2. Lawen, Arthur. Paravertebral Leitungs Anesthesie. Munchen. Med. Wchnschr. 68. 1390-1391 (June 27, 1911).
3. Finsterer, H. Zur Technik der Paravertebral Leitungs Anesthesie. Zenhalblatt (Chir. 39-601, 1912).
4. Kappis, M. Arber Leitung Anesthesie lei Neirer operation und Thoraksuptastive. Zentral bl f Chir. 39, 249, 252. (Zbe) 1912.
5. Braun, H. Local anesthesia, translated by Shields. Philadelphia. Lea and Febiger, 1914, pp. 320-334.
6. Ziegel, P. W. Erfahungen an z 000 paravertebral Leitungs anesthesie in der Gebuntsiafe und Gynak. Med. Klinik. 14 1013-1015. Oct., 1918.
7. Hartel, F. Die Lokal anesthesie. Nene deutsche. Chir. volume 21. 1916, pp. 257-266.
8. Illyes, G. Personal communications, 1923.
9. Snitzer, A. Personal communications, 1923.
10. Illyes, Gard. Adler R. Reports from the Peter Pagmany Urological Clinic of the Royal Hungarian University at Budapest, Feb., 1924.
11. Ibid.
12. Muroya, S. Experimental observations on Novocaine in paravertebral anesthesia. Deutsch Ztschr. f. Chir. Vol. CXXII, 1913, pp 1-25.
13. Reinhard, A. Die Vorzuge der Novokain leitungs anesthesie. Vor der inhalations Narkose. Deutsch. Ztschr f chir Vol. 139, 1917, p.110.

14. Denk, W. Local and conductive anesthesia. Wien Klin Wchnschr. Vol. 33. July 15, 1920; p. 630.
15. Pauchet, V. A propos de l' anesthesie paravertebral. Bull et wena Soc. der chir de Paris. Vol. XLV, 2nd part. 1919, pp. 1577-1578.
16. Duvergey, E. Paravetebral anesthesie per chir 42 530, July, 1923.
17. Farr, R. E. Practical local anesthesia. Philadelphia. Lea and Zepger, 1923, p. 316.
18. Lowry, W. H. Paravertebral anesthesia in abdominal surgery, Illinois Med. Jour. 42. 440-443. Dec., 1922.
19. Meeker, W. R. Nerve blocks anesthesia in general surgery. Minnesota State Med. Jour. 40 Sept., 1923; pp. 123-126.
20. Braun, H. Local anesthesia, translated by M. L. Harris, Philadelphia. Lea and Febiger, 1924; p. 291.
21. Finsterer, H. Local anesthesia. Translated by Nurese. New York. Rebman and Co., 1923; pp. 328-331.
22. Kappis, M. Der Gegenwantige stand der orthicken bestaubunz bei operations an der Harnorgan. Ztschr t Urol. Chir. 10. July, 1922. 114-118.
23. Self, J. Paravertebral Anesthesia, in acute suppurative pleurisy. J.A.M.A. Vol. 80—N.R. 22, June 2, 1923; pp. 1612-1613.
24. Morian, R. Albuminuria following subcutaneous injections of novocain, quoted by Farr, R. E. Practical local anesthesia. Philadelphia. Lea and Febiger, 1923, page 315.
25. Lowsley and Pugh. Kidney operations under Paravertebral anesthesia. Jour. A.M.A. March 29, 1924. Vol. 82, pp. 1011-1016.

SOCIAL HYGIENE AND RACE BETTERMENT

Dr. Walter M. Brunet, American Social Hygiene Association.

There is a persistence today in overcoming distance and in exploring and conquering new physical obstacles that is a new expression of man's struggle with nature. The same state of affairs exists also in public health, social welfare and other fields of human activity. This Conference, for instance, is an earnest of the endeavor to make life longer, healthier, fuller, and richer.

There are at the present time many organizations, both official and voluntary, that are bending every effort to improve man's estate. One is attacking the problem relating to better methods of birth control, another is studying the problem of eugenics and all that it means, still others are endeavoring through educational means to inform not only the young but the parents and grandparents of the essentials of personal hygiene, which must include sex hygiene in order that the young will not be handicapped on this highroad we call life as to essential knowledge relating to their bodies and its functions.

AN EFFORT TO PRESERVE AND STRENGTHEN THE FAMILY

One of the activities of the American Social Hygiene Association is a program that has as a major item an educational approach to the subject of social hygiene. What is social hygiene? Social hygiene seeks to preserve and to strengthen the family as the basic social unit. In the United States the activities that are being stressed in this field are directed specifically toward the adaptation of the sex factor in human life to the growth, happiness, and character of the individual and to the good of society. Indirectly it seeks to encourage all means that tend to build up healthy, happy and socially wholesome life.

These activities are both constructive and remedial. Its constructive activities are mainly educational. They are designed to foster such character education and training from childhood up as shall develop correct attitudes, ideals, standards, and behavior in respect to sex in its broadest sense. Its remedial activities are aimed at securing the most wholesome social environment by the elimination of all factors that tend to weaken and to destroy the home and to oppose the best development of the individual. An outstanding factor is sex delinquency, which results in prostitution and the dissemination of venereal diseases.

We believe that social hygiene education, which is not merely sex hygiene but a careful training looking toward proper sex social conduct,

will make the family all that can be hoped for it. To this end the social hygiene movement looks to the integration of proper material into the education of children at various stages of development through the media of home, schools, churches and other organizations in this and allied fields of endeavor that seek to serve instructively and progressively children and youth. There might be mentioned the excellent work that the Parent Teacher Organizations, Leagues of Women Voters and other similar groups are doing in this field, which will have valuable results in Race Betterment.

TWO DISEASES THAT BLIGHT AND DESTROY

Related to and having an important part in this social hygiene movement are the pathological aspects. Two diseases, syphilis and gonococcal infection, play an important part in this special health program. If we can prevent and control these two diseases, race progress will be tremendously promoted. Syphilis destroys or blights the racial stock. Gonococcal infection destroys the reproductive function. Syphilis is a racial poison. It acts by destroying outright from 50 to 75 per cent of the children before they are born or during the first year of life, and by crippling or weakening a considerable number of those who survive. Syphilis is transmissible to the second generation and this makes it unique among diseases. Syphilis transmitted to offspring is not mere constitutional inferiority, but syphilis. The children who inherit the disease are thought to receive their infection by a transfer of the germs from the body of the mother to the blood of the child. If the child is infected within the first three months after conception, it is almost certain to die and the body to be expelled, constituting an abortion or miscarriage. If the child contracts the disease from the third to the sixth month, it may survive but it is likely to be born prematurely and most probably dead. If infected after the seventh month, it probably will be born alive but die later of the disease. The degree of activity of the infection in the mother plays a large part in the infection of the child. It is possible for a syphilitic mother to give birth to an apparently normal baby.

SYPHILIS IN INFANT PREVENTABLE

The hopeful side of this condition is that it is preventable and curable. The demands are great, however, and the burden is upon the physician who sees and cares for the pregnant woman. Williams of Johns Hopkins University showed that less than ten intravenous arsphenamine treatments before the sixth month of pregnancy will, in upwards of 80 per cent of the cases, assure a child free from the disease. This does not cure the mother.

Within the past two years our Association has canvassed a large number of prenatal clinics in different parts of the country and put to them leading questions as to their plan for discovering syphilis in the pregnant woman. While some of the clinics are doing excellent work, a considerable number are not taking advantage of the opportunities. In carrying out prenatal work there is a wonderful opportunity offered physicians to prevent syphilis being transmitted from parent to offspring. We have at our command at this moment means to stop the bringing into the world of children with heredo-syphilis, and if our present knowledge could be applied practically, the birth of an infected child would be a rare event.

There is no fairer field in the science of medicine in which such immediate and far-reaching results can be confidently expected than in this one. In this activity alone we have a golden opportunity for securing immediate results. Of course there are many other excellent opportunities offered us to bring this infection into the group of controlled diseases. By seeking out all possible clues as to the source of the infection and those exposed, we can expect rapid advances to be made. Physicians must examine all sources and see that other cases are discovered and placed under treatment. Many clinics have built up a variety of services, by such social service and follow-up methods, and men, women and children are receiving excellent care, both from private physicians and from free clinics. It is futile to treat a man or a woman who is married and who has syphilis and not to bring the marital partner and the children into the clinics for examination and treatment when necessary.

MORE SCIENTIFIC INVESTIGATION NEEDED OF GONOCOCCAL INFECTION

As to the second disease, gonococcal infection, the problem is not simple. The reproductive function is often lost in both males and females, more frequently in the female on account of the anatomy of the sexual organs. The drug mercurochrome has seemed to offer something new in the field of treatment. Much study is still needed in this field.

Gonococcal infection of the eye, which is a tragedy, is the cause of a large percentage of total blindness, and it can be prevented. We have in a large number of states compulsory laws requiring the Crede method for prevention of opthalmia neonatorum. If every child born is given the benefit of this prophylactic method, blindness due to this cause would disappear at once.

Gonococcal vaginitis in little girl children is a distressing condition, contracted usually from careless adults, toilet seats, bed pans, soiled clothing and other sources. One of the frequent sources is the habit

of sleeping with an infected adult. This condition in the young girl is thought to lead often to sterility in adult life. How much is not known. Treatment in competent hands promises in the main good results. The subject needs much more scientific investigation.

We have prepared exhibitions for display in the state and local medical groups in an endeavor to secure the active interest and co-operation of the medical profession and to arouse them to the importance of considering these diseases in their daily work. No lane is so long in medicine that one may not find syphilis or gonococcal infection at the turning. Doctors must raise their evidence of suspicion regarding venereal diseases and seek diligently to find it if it be present, and by expert treatment control and cure it.

Race Betterment depends upon a multitude of activities and they cover the whole field of human endeavor. There are seemingly endless problems and complications. But we are making progress. In all of our activities directed toward Race Betterment, we must remember that whether we deal with experiment, with practice or with public health, the intelligence, sincerity and zeal with which we perform our tasks find their reflection, immediate or remote, in terms of happiness or sorrow.

LYMPH POISONS—THEIR EXTRACTION IN THE TREATMENT OF INTERNAL DISEASES

Dr. Bertram Ball, Director Organization Department, American Academy of Applied Dental Science; Director Institute of Oralogy, New York City.

It is a privilege and a pleasure to address this Conference and to have the opportunity personally of congratulating you upon the splendid work you are doing. We owe a tremendous debt of gratitude to Dr. John Harvey Kellogg, the founder of this great movement, and to his able associates. Millions yet unborn will secure the blessings of his great work.

Race Betterment, after all, is fundamental to every civilized country; and Race Betterment results primarily from universal better health, which, in turn, is bound to follow a better understanding of the human body—Nature's supreme work.

One of the country's most brilliant medical men once told me that 90 per cent of the credit for his achievements should go to Nature herself, and that the more he learned about the normal functioning of the body and applied those principles, the more success he attained. Science is constantly making discoveries, but the greatest discoveries of the age are those that give Nature the chance to do her utmost.

It has been my experience that progressive professional men welcome constructive advice, and absorb eagerly new proved discoveries in the interests of health irrespective of who discovers them. There is not an individual in this assembly who shuts his ears to constructive ideas. The mere fact that you are interested in Race Betterment indicates that you are interested in universal better health. I feel, therefore, that you will be keenly interested in the results of a research work along biologic lines, as I think that such discoveries will go far to prevent internal diseases. Health is secured as the result of an endless series of adjustments involving the various problems of biochemistry, sanitation, nutrition, psychology, bacteriology, education, etc.

INFECTED MOUTH CONDITIONS ARE DANGEROUS

Thirty years ago my professional life began. Study and experience caused me to see that the extraction of some teeth had health advantages, but this was not the approach or culmination of a biologic mouth health service. The condition of some extracted teeth and adjacent alveoli aroused a still deeper interest. There was no dental college in my part of the country that could help, and therefore I had to shop

around for knowledge. The education and the cooperation of patients have made the advance from the mechanical (dentistry) to the biologic (oralogy) possible. The many progressive steps could not be accomplished without their helpful and interested development into the happier and freer type of better living.

As the extraction of teeth, per se, proved long ago not altogether satisfactory, naturally the question has arisen many times, "Is tonsil removal proper in a general or body health service?" We are being led to appreciate that time, study and health results will give the same answer as our experience with extraction of teeth. Broadly speaking, I believe that infected mouth conditions are more dangerous than infected tonsils, because of the pressure of mastication and because health or its restoration is a chemical problem, not a mechanical problem. Realizing the relative importance of our health gift to our offspring, and as oral advisor for hundreds of persons, these questions have been studied from all sides for many years.

For fourteen years the cause problems of nerve, mental and internal diseases, the influences of mouth conditions upon such, and their elimination, have been my special study and practice. The question as to which is a primary cause or a secondary cause has been given comparatively no study, nor has the selective activity of any particular bacteria.

THE RELATION OF LYMPH POISONS TO HEALTH

All changes within the body are the results coming from the five streams of life—blood, lymph, food, air, and mind. As the lymph stream carries the poisons of the body, it necessarily follows that the physical and chemical side of life can be improved as we understand how to extract the lymph poisons from the body. This assertion is made not from a theoretical vision but after many years of practical cooperation and health results that can be checked by anyone.

Please do not confuse the following differentials—oralogy and dentistry, lymph and lymph poisons. Lymph is poured into the blood stream at the portal vein. The lymph poisons are discharged from the body by the chemical and physical actions within the accessory sinuses and the nasal passages. A complete research reveals that it is only within the last few years that the physiological function of the antra and accessory sinuses has attracted attention.[1]

Schaeffer has greatly aided in his very complete work upon the anatomy of these parts. Andre, Grűnwald, Mullin and Ryder, Noyse and Dewey, Talbot, Victor Hugo Jackson of New York, McCollum, Carrel, Cotton, Clark, Novitzky, and many others have performed very important work in these studies, and represent the foundation upon

[1]Physiological Function of the Antra and Accessory Sinuses. Dental Outlook, December, 1926.

which this advance has been made. Deposits on teeth are removed and noses blown. But what function is tartar formation, and nasal discharge?

As a mouth physician (oralogist), allow me to go on record with the statement that tooth problems constitute one of the largest factors in general health because they and mouth bacteria affect all parts of the human body. The health possibilities of a clean mouth area cannot be overestimated. Here is an abounding field for scientific studies. We have operated upon via alveolar ridge or a tooth socket, 1709 antra. Our patients' ages have been from 10 to 76 years. All but 36 of these have had demonstrable mouth pathology. An inference that infected antra result only from tooth or mouth infection should not be drawn from the facts already stated. The proximity of the thyroid and parathyroid glands would indicate that a healthy physiological condition in adjacent mouth area is a very important factor in the calcium and iodine contents of the blood.

WHAT CONSTITUTES A "CLEAN MOUTH"?

Relative health importance of physical body exercise to all biochemistry should be understood and properly placed so that the physiological changes brought about by the exercise factor can be properly studied. What constitutes a clean mouth, according to the questionnaire of the American Academy of Applied Dental Science,[2] is an important factor in any health or throat diagnostic work. That group of progressive students who are working upon the "Clean Mouth" studies deserves the conscientious consideration of all. Tooth diagnosis is not an easy accomplishment. Why is tooth or tonsil removal helpful for one patient while to another it shows no benefits?

In the efforts to restore to health many who were chronically sick, we have been compelled in our studies to seek the aid of any or every positive health-building factor. The mechanical removal, per se, of some pathological condition is not satisfactory, is not positive for health. A complete study of the literature of past antra pathology and treatment, its diagnosis and prognosis, is very unsatisfactory either to progressive practitioners or to patients. The detoxifying value of the chlorine antiseptics, and the biological research of Doctor Carrel and a group of French bio-chemists and many others, have been large factors in bringing these studies to the point they have already attained. Definite knowledge of the complete cellular bio-chemistry in the elimination of bacteria or their toxins will produce even greater health results. Diagnostic methods are somewhat advanced. Biological foundation is supreme in the study of normal cellular activity. The

[2]American Academy of Applied Dental Science Clean Mouth Questionnaire. American Medicine, new series, Vol. XIX, No. 10, pages 594-598, October, 1924.

increase in heart, nerve and mental diseases should lead to a complete study of the elimination of lymph poisons.

EXTRACTION OF BODY POISONS HAS BROUGHT FAVORABLE RESULTS

The appreciation of this uncharted function, or the extraction of these body poisons, has brought about extremely favorable health results for many chronically sick patients who were suffering from nerve, mental and internal diseases, some skin diseases, chronic bronchitis, nasal catarrh, asthma, hay fever, and various forms of eye and ear diseases. Understanding this function might produce a better type of autogenous vaccine. There are psychologic, economic, cooperative and bio-chemical problems yet to be solved. It will take many years for medical and dental practitioners to study and talk the same language or to understand the various factors involved. The mechanical basis of dentistry shows some signs of appreciating the biological sensibilities of adjacent glands and tissues; but the patient is largely guided by his emotions—pain and psychology will be the dominating factors for a long time. The pulpless-tooth problem has many years apparently to travel before its scientific destination is reached.

The rôle of the vitamins is so young in appreciation that there are many possibilities in this health building and therapeutic branch of the immediate future.

In all this lymph poison extraction, no habit-forming drug has been used. There has been no quinine, iron, arsenic, insulin or strychnine administered, in the blood studies to be related. These reports have been approached entirely from the biological appreciation of the entire normal cellular activity and a realization that the liver metabolism was a very necessary part in all work of lymph poison extraction. Washing the antra and accessory sinuses with para-toulene-sulpho-chloramide has proved most helpful. Ralgic therapy is used to stimulate this function in various degrees of intensity and duration. Blood and urine studies indicate chemical changes. Patients' feelings indicate nerve reactions. Ralgic therapy is the basis of a natural increased blood and lymph action without the breaking down of the muscle cell tissue by actual body exercise.

The following typical blood studies reveal some of the work accomplished and the many paradoxes yet to be studied:

54-Year Male: Duodenal ulcer of about two years' standing; 30 years of constipation and anemia.

March 29, 1926:

R. C.	4,610,000
W. C.	10,100
Polies	51%
Lymphs	44%

One week after double antra operation and complete hospitalization oralogy:

R. C.	5,000,000	8% improvement
W. C.	8,400	16% decrease
Polies	79%	
Lymphs	20.9%	50% improvement

54-Year Contented Mother, with three grown children. Left facial neuralgia, sciatica right leg, high blood pressure in menopause, very little articulation for mastication. Pyorrhea, one loose tooth removed, ralgic therapy, no antra operation, office technique only. Lower restoration made possible complete mastication.

May 19, 1924:

R. C.	4,228,000	
W. C.	3,240	
Polies	69%	
Lymphs	21%	

Three weeks later:

R. C.	6,432,000	52% improvement
W. C.	5,800	
Polies	84%	
Lymphs	13%	34% improvement

34-Year Male, suffering from sexual neurasthenia. Double antra operation, diet and ralgic therapy.

May 24, 1924:

R. C.	4,500,000	
W. C.	3,600	
Polies	70%	
Lymphs	23%	

Five weeks later:

R. C.	7,456,000	66% improvement
W. C.	6,600	81% increase
Polies	83%	
Lymphs	11%	50% improvement

59-Year Male. Three generations of state mental institutional commitments. Confined to a sanitarium for last five years. Double antra operation complete hospitalization oralogy.

January 24, 1927:

Polies	56%	
Lymphs	38%	

Three days later:

Polies	70.7%	
Lymphs	29%	25% improvement

(We hope through cooperation so to help a fourth generation offspring, now six years, that science will again demonstrate its value to man.)

59-Year Male. Always aggressive and thinks himself in abounding health. For many years chronic pyorrhea and constipation. Elimination five years ago. Antra not opened. Now retains seven pulpless teeth. Has had some pulpless teeth in lower jaw for 26 years.

1924 Blood Examination:

R. C.	4,550,000
W. C.	5,000
Polies	58%
Lymphs	42%

Three years later:

R. C.	4,160,000
W. C.	7,800
Polies	61%
Lymphs	33%

These factors, regular outdoor exercise, oral prophylaxis, and constant attention to diet and his teeth, cause this man to believe that his health is beyond improvement. We know that it can be better.

27-Year Male. Married. 6% sugar in urine. 59 fillings and 49 cavities in 26 vital teeth and 2 pulpless teeth. Double antra operation. Two weeks hospitalization oralogy.

May 16, 1927:

R. C.	5,103,000
W. C.	8,100
Polies	65%
Lymphs	29%

Four and a half weeks later:

R. C.	4,800,000
W. C.	12,000
Polies	71%
Lymphs	28.9%

We are studying what the 60 per cent increase of white cells indicates. Sugar negative ever since ten days after operation.

Six months later:

R. C.	4,620,000
W. C.	6,800
Polies	65%
Lymphs	31%

These are just a few case histories. Like the hundreds of our other records, we think they indicate that universal better health, and consequent Race Betterment, will assuredly result from a closer appreciation of the vital influence of a clean mouth area.

Appreciating the immortality of animal cell life as demonstrated by Dr. Carrel, can we now approach the many problems of washing and building the body cell life?

I regard the concentration of studies in this direction as the paramount health requisite of the age. Oralogy based on biology will give its most conscientious study to life extension and Race Betterment.

MATERNAL MORTALITY, A DETERRENT FACTOR IN RACE BETTERMENT

Samuel J. Crumbine, M.D., General Executive of the American Child Health Association, and Dorothy F. Holland, Ph.D., Staff Associate

The results of the successful attack of leaders in preventive medicine on such diseases as smallpox, typhoid fever, diarrhea and enteritis, tuberculosis and diphtheria are well-known. The passing of the first quarter of this century has seen the tuberculosis death rate decline from 202 to 87, the typhoid death rate from 36 to 8 per 100,000 population. The reductions in many other preventable diseases, notably those of infancy, have been of a similar order.

Not so well known, perhaps, is the situation in regard to maternal mortality. Twenty-five years have seen practically no reduction in the death rate from preventable causes associated with childbirth. This contrast is brought out in Chart 1.

A consideration of the maternal mortality experience of certain European countries, and a study of the specific causes of maternal deaths, which we present below, prove the reduction of these deaths to be possible. Why, then, do maternal deaths fail to show the downward trend of the majority of other preventable diseases in this country?

Many hypotheses might be proposed in an effort to explain this problem. We believe that the inherent difficulty of its association with childbirth is its most baffling aspect.

The best response to voluntary or enforced measures for the prevention of disease comes from an educated public which meets the preventive measure half way. In their campaigns against tuberculosis and cancer, the leaders in preventive medicine have taken the public directly into their confidence, instructing them concerning symptoms, means of prevention and treatment.

This method has been used with success in campaigns for the prevention of smallpox, typhoid fever, and diphtheria. But it is a method obviously unsuited to the dissemination of knowledge concerning the prevention of maternal mortality.

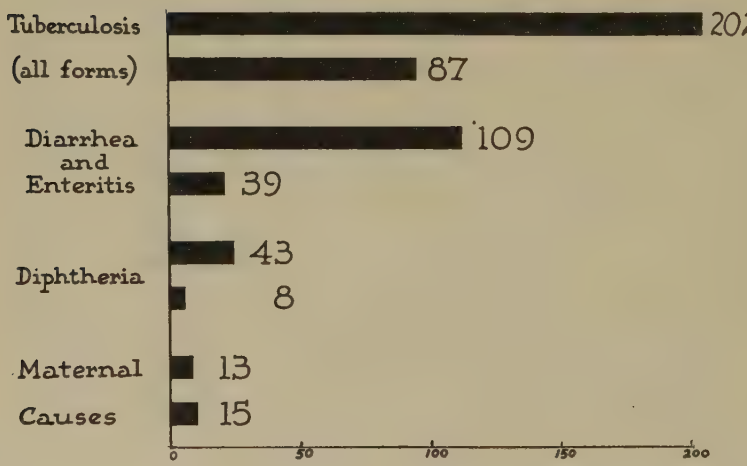
In the prevention of maternal mortality, the educational campaign is necessarily directed toward a more restricted public, composed of research and practising physicians, public health nurses and midwives, and the expectant mothers. Those who guide the course of preventive medicine must stimulate the interest of professional groups in the

problem of maternal mortality; these groups must, in turn, act as middlemen, delivering a specific and personal message to expectant mothers.

It is this necessary substitution of personal for mass education which makes the campaign for the prevention of maternal mortality peculiarly difficult, and successful in proportion to the number of those engaged in individual teaching.

CHART I

Deaths from Tuberculosis (all forms) Diarrhea, Enteritis, Diphtheria & Maternal Causes U.S. Expanding Death Registration Area, 1900 & 1925 compared Deaths per 100,000 Population



U.S. Mortality Statistics 1920 p.18 and Press Release, Dec. 28, 1926 U.S. Census Bureau

The presentation of the subject of the mortality of women at childbirth to this group is, therefore, a special privilege, since your professional training, and avowed interest in Race Betterment, fit you to assist actively in the campaign for the reduction of maternal mortality.

MATERNAL MORTALITY SHOWS NO TENDENCY TO DECLINE

We have referred above to the stationary nature of the death rate from causes associated with childbirth. Using the only available rate for the year 1900, i. e., deaths from puerperal causes per 100,000 population, we find a rate of 13, and twenty-five years later, in 1925, a rate of 15.

It may be thought that this increase in the number of puerperal deaths per 100,000 total population is an apparent one due to the expansion of the Death Registration Area, the decreasing birth rate and improvements in certification of causes of death. Woodbury[1] found, after eliminating the influence of these factors, that the death rate from all puerperal causes except puerperal septicemia had remained approximately the same, the death rate from the latter having undergone a definite decrease. Allowance for the influence of these factors, therefore, changes a slight increase in the death rate from puerperal causes to a slight decrease.

The mortality of women from these causes is, however, best described by a rate in which maternal deaths are related not to the total population but to the exposed group, i. e., childbearing women. A measure of the number of childbearing women is available through the number of births registered. But information concerning the number of births occurring in this country has been available only since 1915, when birth registration in ten states was satisfactory enough to permit the United States Bureau of the Census to designate them as a "Birth Registration Area." This area has grown until, in 1927, 43 states were included. But even at the present date information on stillbirths is incomplete. We are unable, therefore, to measure the number of maternal deaths occurring among a given number of confined women, and must record, instead, the maternal deaths among women giving birth to live infants.

Maternal mortality measured by this more accurate "maternal mortality rate" shows no tendency to decline, however, 6 maternal deaths occurring in every 1,000 live births in 1915, the same number being reported in 1925.

MATERNAL DEATHS CONSTITUTE THE LEADING HEALTH PROBLEM OF FEMALES OF THE CHILDBEARING AGE

Public health endeavor is most successful when it is specific. Infant deaths began to decline when an attack was made on diarrhea and enteritis, a leading cause of infant mortality. The problem of childhood mortality is being solved by special campaigns to prevent deaths from the communicable diseases, notably diphtheria, and accidents. The mortality over age 45 presents the problem of the degenerative diseases, cerebral hemorrhage, heart disease, cancer and nephritis.

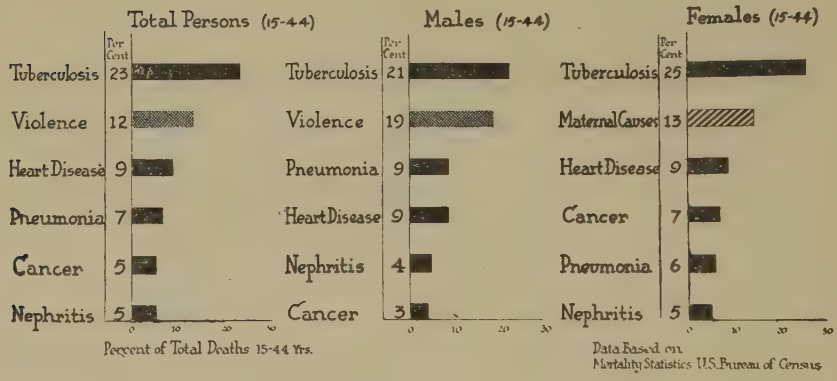
Likewise, the period between childhood and middle age is characterized by its particular mortality problems. As a result of the teachings of the National Tuberculosis Association, even the layman recognizes tuberculosis as a problem of the young adult.

[1]Woodbury, Robert Morse, Ph.D. "Infant Mortality and Its Causes," Appendix, pp. 180-192, Williams and Wilkins, Baltimore, 1926.

An important medical problem of both sexes in the age period 15 to 44 is, then, tuberculosis. If we now consider the sexes separately (see Chart II), we find that among males 15 to 44 years old the cause of death second in importance to tuberculosis is violence. Among females, however, it is deaths from causes associated with childbirth that stand second to tuberculosis.

CHART II

Mortality of Young Adults Ages 15-44
Males, Females, and Total Persons Compared
U.S. Registration States (Including D.C.)
1924



The data on which Chart II is based represent the 39 states which comprised the United States Death Registration Area in 1924. Let us compare the facts for the registration states taken individually. We find that in 33 states, maternal deaths were second in importance only to tuberculosis as a cause of death among women 15 to 44 years of age. In one state, maternal deaths shared second place with heart disease. In one state, maternal deaths were exceeded in number by deaths from both tuberculosis and diseases of the heart. In four states, maternal deaths formed the leading cause of death of women 15 to 44 years of age.

The relation of maternal deaths to other leading causes of death varies within the age period 15-44. This is shown in Table I.

Table I

THE RELATION OF MATERNAL DEATHS TO TOTAL FEMALE DEATHS 15-44 IN 39 STATES OF THE DEATH REGISTRATION AREA 1924

Age Period	Distribution of 39 States by Relative Position of Maternal Deaths		
	1st	2nd	3rd
15-44	4	34	1
15-19	3	30	6
20-24	4	35	0
25-29	7	32	0
30-34	9	30	0
35-39	12	19	8
40-44	1	5	33

There is a progressive increase in the number of states in which maternal deaths constitute the leading cause of death, as we pass from the first to later quinquennia of the 15-44 year period. For example, maternal deaths outnumber deaths from all other single causes among women 20 to 24 years of age in four states, but among women 35-39 years of age, maternal deaths constitute the leading cause of death in 12 states.

This is due to the changing relative position of tuberculosis as a cause of death, as we may see by inspection of Table II and Chart III.

Table II

DEATHS FROM IMPORTANT CAUSES PER 100 TOTAL DEATHS OF FEMALES BY AGE—UNITED STATES REGISTRATION STATES—(EXCLUDING DISTRICT OF COLUMBIA)—1924

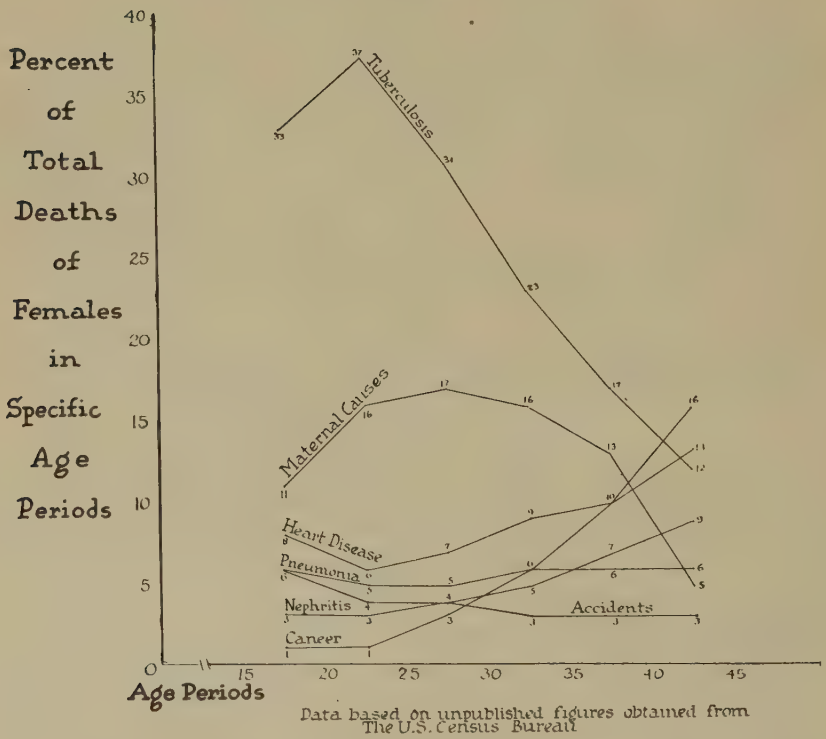
Cause of Death	AGE AT DEATH						
	15-44 Years	15-19 Years	20-24 Years	25-29 Years	30-34 Years	35-39 Years	40-44 Years
All Causes	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Tuberculosis (all forms) (31-37)	24.6	32.5	36.6	31.1	23.0	16.6	12.4
Diseases of the Puerperal State (143-150)	12.8	11.4	15.6	16.6	15.9	12.6	5.2
Diseases of the Heart (87-90)	9.0	7.9	6.0	7.0	8.5	10.4	13.1
Cancer (all forms) (43-49)	6.6	1.0	1.1	2.8	5.9	10.0	15.5
Pneumonia (all forms) (100-101)	5.6	5.8	5.1	5.3	6.0	6.0	5.6
Nephritis (128-129)	5.2	2.9	2.8	3.6	5.2	6.6	8.6
Accidents (175-189, 192-96, 201-2)	3.8	6.3	4.3	3.7	3.3	3.4	3.0

Deaths from tuberculosis reach their peak for females in the age period 20-24, declining sharply thereafter. As deaths from tuberculosis decrease, deaths from maternal causes become relatively more important, until they, too, decline as the birth rate decreases after age 35.

In the last quinquennium, 40-44, the mortality picture again changes, due to the increasing importance of heart disease and especially cancer, as causes of female deaths. Indeed, cancer was the leading cause of death among women 40-44 years of age in 28 of the 39 states of the Death Registration Area, in 1924.

CHART III

Deaths from Important Causes Per 100 Total Deaths of Females, by Age U.S. Registration States (Excluding District of Columbia) 1924



Data based on unpublished figures obtained from The U.S. Census Bureau

Of great significance also are data which enable us to answer the question: What is the ratio of maternal deaths to total deaths of females in the age period 15 to 44? These data are contained in Table III. It is possible to present figures for only 31 states, since in 8 states the total number of deaths of females in each quinquennium from 15 to 44 years was less than 100.

Table III

FREQUENCY DISTRIBUTION OF RATIOS OF MATERNAL DEATHS TO TOTAL DEATHS OF FEMALES 15-44 YEARS 31 REGISTRATION STATES—1924

Age Period	Number of States in which Maternal Deaths Constitute Specified Percentages of Total Deaths					
	Under 5%	5-9%	10-14%	15-19%	20-24%	25% and over
15-44	0	1	22	8	0	0
15-19	0	10	12	8	1	0
20-24	0	0	14	12	5	0
25-29	0	0	10	12	8	1
30-34	0	0	11	15	4	1
35-39	0	3	22	5	1	0
40-44	13	18	0	0	0	0

(The data in this table are based on Table I of the Appendix.)

In 30 of 31 states for which data were summarized, ten or more maternal deaths occurred among every 100 deaths of women from all causes, in the age period 15 to 44 years. If the quinquennial age periods from 15 to 44 are studied, it is found that fewer maternal deaths occur among every 100 deaths of females from all causes, at the extremes of the child-bearing period, i. e., 15-19 years and 40-44 years. This is to be expected, since the birth rates at these ages are lower than in the middle of the child bearing period.

The quinquennia from 20 to 34 years, on the other hand, show a much higher ratio of maternal to total deaths. In over half of the 31 states whose deaths were studied, 15 or more out of every 100 total deaths of females in the quinquennia 20-24, 25-29, and 30-34, were due to causes associated with childbirth.

The above considerations support the conclusion that, as a leading cause of death of women in the age period 15 to 44, maternal mortality demands the concentrated attention of those who have assumed responsibility for the maintenance of the public health.

While maternal deaths are numerically exceeded by tuberculosis deaths among women of the childbearing period, we believe they constitute, nevertheless, the leading health problem of females of this age period when their immediate and ultimate consequences are considered.

WIDESPREAD CONSEQUENCES OF MATERNAL DEATHS

The immediate consequences of a maternal death are a possible stillbirth, or, if the birth be live, the death of the infant during its first month, or first year of life. In the statistical study of 22,967 live births and 813 stillbirths made by the United States Children's Bureau,[2] it was found that the stillbirths constituted about one-third

2. United States Department of Labor—Children's Bureau: "Casual Factors in Infant Mortality." Publication No. 142 (1925), pp. 33, 34, 168.

of all the births to mothers who died within the month following confinement—"almost all from causes directly connected with pregnancy or confinement."

Among 1,003 infants in Massachusetts born to 984 women who died from maternal causes, Coffin[3] reported that 289 were stillborn.

Equally serious is the effect of maternal mortality on the chances of survival of live infants. In the Children's Bureau study referred to above, it was found that the deaths of infants born to mothers who died at or during confinement were over four times as numerous as those among infants whose mothers lived for a year or more after their birth. It is true that not all deaths of these mothers were due to maternal causes. However, pregnancy and confinement probably were the direct or contributory causes in a large number of these. In the Massachusetts study of Coffin, 141 of 1,003 infants born of mothers who died at childbirth died during the first year of life; the majority of these deaths, 116, occurred during the first month.

Premature birth occurs more often among women who die from causes associated with childbirth than among other women. In the Children's Bureau investigation quoted above, it was found that five times as many births to women who died within one month after confinement, when most of the deaths were due to maternal causes, were premature, as to women who died one month or one year after confinement.

The ultimate consequences of maternal deaths are measured in their effect on the lives of surviving children. The 984 mothers whose deaths were studied by Coffin were survived by 2,156 children. An average of two children surviving each maternal death is probably a fair estimate of the facts. Thus, the annual loss of women from maternal causes is doubled if its effect on the future of their children be considered.

In the case of infants, the chief result of a maternal death is the enforced substitution of artificial for breast feeding. The high infant mortality rate of artificially fed infants during their first month of life is well known. Improvements in the safety and cleanliness of the milk supply through pasteurization, and increased knowledge of vitamin requirements, have reduced the danger of artificial feeding during the later months. However, it is clear that loss of a mother increases the hazards of the first year of infancy for the majority of infants.

Among older children, the chief hazard of motherlessness is its social effect. The social worker is familiar with the broken home as a cause of delinquency, and a large per cent of broken homes results

3. Coffin, Susan M., M.D., DeKruif, Mary F., M.D., et al. "Maternal Mortality in Massachusetts." A Study of 984 Deaths in the Puerperal State, Journal American Medical Association, 86: 408, Feb. 6, 1926.

from death of the mother. Bridges[4] quoted Healy's statement that "about 62 per cent of the delinquents coming from broken homes had lost either father or mother or both."

Shideler[5] found that almost one-fifth of 7,598 delinquent boys in 31 states of this country had lost mothers, or both parents. Slawson,[6] in a comparative study, found that only 6 per cent of New York City public school boys were motherless, or orphans; but from 14 to 29 per cent of delinquent boys in New York State institutions were motherless, or orphans.

It is unnecessary to present further data to support the contention that maternal deaths, because of the loss of the mothers themselves, the resulting hazard to the immediate health of surviving children, and the ultimate possible disruption of the family, constitute a challenging health and social problem among young adult women.

Is, then, this mortality of women at childbirth reducible? Does the failure of these deaths to decline indicate that preventive medicine offers no method of preventing them?

POSSIBILITY OF MATERNAL MORTALITY REDUCTION

The maternal mortality of certain foreign countries points to the goal which it is possible to obtain. Japan, Denmark, Italy, the Netherlands, Norway, lose about one-half as many women from maternal causes as does the United States. England and Wales and Germany have higher maternal mortality rates, but these also are exceeded by the rate for the United States Birth Registration Area. An international comparison of this kind is made difficult by the lack of uniformity in birth and death registration methods. However, reported observation of visitors to these European countries confirms the indication of these figures.

The proof of the possibility of reduction of maternal deaths is best shown by a consideration of the specific causes from which women die in childbirth, shown in Table IV below, and, graphically, in Chart IV.

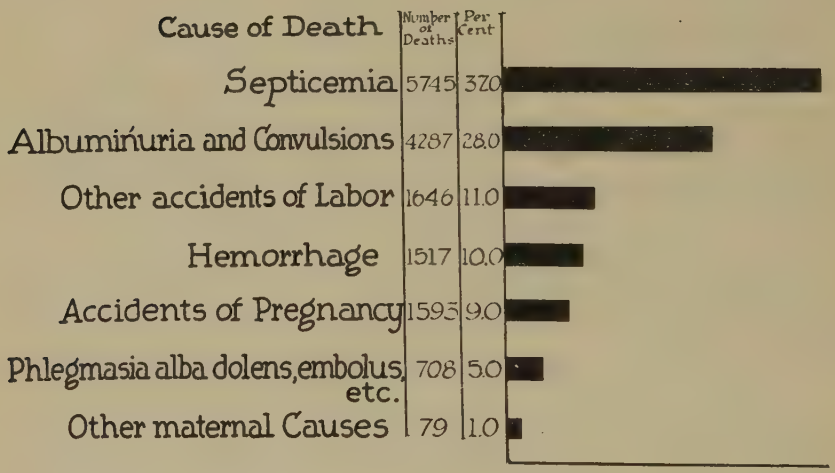
4. Bridges, K. M. B.: "Factors Contributing to Juvenile Delinquency," Journal American Inst. Crim. Law and Criminology. 17: 531, Feb., 1927.

5. Shideler: "Family Disintegration and the Delinquent Boy in the United States," American Journal of Obstet. and Gyn. 8: 713, Jan., 1918.

6. Slawson, John: "Marital Relations of Parents and Juvenile Delinquency," Journal of Delinquency. 8: 278, Sept.-Nov., 1923.

CHART IV

Causes of Maternal Deaths United States Death Registration Area 1924



Data based on Mortality Statistics, U.S. Census Bureau-1924 Table 8

Table IV

CAUSES OF MATERNAL DEATHS—U. S. DEATH REGISTRATION AREA 1924

Cause of Death	Number of Deaths	Percentage of All Maternal Deaths
All puerperal causes	15,375	100%
Puerperal septicemia	5,745	37
Puerperal albuminuria and convulsions	4,287	28
Other accidents of labor	1,646	11
Puerperal hemorrhage	1,517	10
Accidents of pregnancy	1,393	9
Puerperal phlegmasia alba dolens, embolus, etc.	708	5
Other puerperal causes (Int. List. Nos. 149, 150)	79	0.5

In the United States Death Registration Area in 1924, thirty-seven per cent of the deaths of women from all puerperal causes were due to puerperal septicemia, twenty-eight per cent to puerperal albuminuria and convulsions.

That puerperal septicemia is largely preventable is commonly accepted. In the words of the Scottish Departmental Report,[7] "The idea of preventability is so interwoven with the history of sepsis that the whisper of the word evokes at once the suggestion of failure." The experience of many municipal and private prenatal clinics, notably those of the Detroit Department of Health under the direction of the late Dr. Walter E. Welz,[8] shows that the reduction of puerperal septicemia is a practical possibility. The Detroit Clinics reported a 75 per cent reduction in maternal deaths due to puerperal septicemia, among women whom they supervised in the prenatal period.

It is also generally recognized that deaths due to puerperal albuminuria and convulsions may be reduced by medical supervision during the prenatal period.

If an attempt were made to apply existing knowledge of the means of preventing these two causes of death alone, maternal deaths could probably be reduced in this country to two-thirds of their present number. There are admittedly further possibilities of reduction among the puerperal deaths from other causes. An increasing number of reports coming from official health agencies give convincing proof of the value of prenatal care in reducing maternal mortality, and, as an indirect result, a lowered number of stillbirths and deaths of infants. Certain voluntary social agencies, in an attempt to prevent the disorganization of the home, with possible resulting dependency, have incorporated medical and nursing supervision of expectant mothers in their programs.

AN EFFECTIVE PRENATAL PROGRAM

The requirements of a prenatal program are simple. They demand examination of the expectant mother monthly by a physician with assistance in observation by a trained public health nurse. Physicians we have in sufficient numbers, at least in urban areas, to meet the demands of the program. The number of public health nurses available for this work is increasing.

What are the necessary steps to make the program for the care of expectant mothers a vital and effective one in every American community? We need, first, assurance that our obstetrical practice is beyond reproach. Watson[9] in a recent paper discussed "The Responsibility of the Obstetric Teacher in Relation to Maternal Mortality and Morbidity." He pointed out the need for preaching against "meddlesome midwifery" by "a redoubled effort on the part of teachers to

7. Report of the Scottish Departmental Committee, "Puerperal Morbidity and Mortality:" H. M. Stationary Office (1924) p. 8.

8. Welz, Walter E., M.D.: "The Development of Prenatal Care in Detroit," American Journal of Obstet. and Gyn. Vol. 11, No. 5, pp. 671- 681, May, 1926.

9. Watson, B. P., M.D.: American Journal of Obstet. and Gyn. 14: 277. Sept., 1927.

impress upon their students the essential normality of the vast majority of cases and the dangers of unnecessary interference." This requires increased attention to clinical obstetrics in the medical school curriculum. Watson also emphasizes the responsibility of the obstetric teacher for "guiding and teaching" students in the prenatal clinics. The student must "be impressed with the importance of prenatal care and see the rapid improvement in the patients as the result of appropriate treatment begun early."

On the medical school, then, and especially on leaders in obstetrical teaching, rests the initial responsibility in the program for the reduction of maternal deaths.

Well trained physicians thus assured, it is then necessary to teach expectant mothers to seek medical care in the prenatal period. This is an educational problem, the solution of which requires methods peculiar to it. As pointed out above, mass education fails here. We must begin by teaching the father. Dr. James Fenton,[10] Medical Officer of Health of Kensington, England, has begun to solve this problem by giving instructions in *"fathercraft,"* addressing "groups of fathers on the importance of skilled ante-natal advice." We believe Dr. Fenton to be a pioneer in this work.

Intelligent parents who recognize the value of prenatal care for themselves must then demand this for others. The citizens of every community should demand the provision of prenatal care by their city health department. Those expectant mothers unable to afford the care of private physicians must be aided by official agencies, and city, state, and federal health organizations should look upon the provision of prenatal care as a primary obligation.

The loss each year of about 16,000 mothers in childbirth means 16,000 homes disorganized each year. The cumulative effect of this tragedy is an appalling menace to the home, which is the bulwark of our national and racial stability and the foundation of our civilization. It is the responsibility of groups such as those gathered here in the interests of Race Betterment to act as interpreters of this message to other professional groups and so to stimulate public sentiment in the need for care of the expectant mother that failure to provide this care will become offensive to the public conscience.

10. Fenton, James, M.D., D.P.H.: "Fathercraft." Report of the Proceedings of the Fourth English Speaking Conference on Maternal and Child Welfare. London, 1926, pp. 59-66.

Appendix Table I

DEATHS FROM CAUSES ASSOCIATED WITH CHILDBIRTH PER 100 TOTAL DEATHS OF FEMALES, FOR EACH REGISTRATION STATE BY AGE—1924

State	Puerperal Deaths per 100 Total Deaths at Age						
	15-44	15-19	20-24	25-29	30-34	35-39	40-44
California	9.4	8.1	12.3	13.5	12.3	8.4	3.3
Colorado	12.6	12.7	17.8	15.6	12.7	12.1	5.6
Connecticut	12.7	6.6	11.8	18.8	17.8	13.9	4.9
Delaware*	11.2	21.6	11.5	16.2	13.5	6.1	3.5
Florida	15.5	24.7	21.6	14.7	17.2	11.8	4.8
Georgia	14.2	17.7	15.7	17.8	15.0	13.2	6.3
Idaho*	17.9	12.3	20.9	18.6	29.0	18.2	7.1
Illinois	10.7	8.9	14.0	13.9	14.8	10.1	3.5
Indiana	11.9	10.4	15.7	13.0	16.9	11.1	4.5
Iowa	16.0	13.2	22.9	21.9	20.1	13.1	6.5
Kansas	15.8	15.6	22.5	20.0	19.3	14.1	7.1
Kentucky	13.8	15.3	17.3	16.4	14.3	13.4	5.7
Louisiana	12.7	17.4	17.4	13.8	12.2	10.8	4.2
Maine	19.3	11.0	24.6	28.0	30.4	15.1	6.2
Maryland	10.8	12.0	12.8	12.3	16.1	8.9	4.7
Massachusetts	14.3	8.1	13.1	21.4	21.5	16.0	5.2
Michigan	14.7	12.8	16.4	20.2	17.9	14.9	5.9
Minnesota	11.7	6.4	12.6	17.2	15.5	13.4	4.6
Mississippi	12.3	18.3	13.1	12.5	12.1	12.1	5.4
Missouri	11.2	12.2	14.5	13.8	12.9	10.0	5.1
Montana*	14.5	14.7	14.9	23.9	20.0	16.3	1.1
Nebraska	17.9	11.0	23.5	24.7	20.2	21.2	7.5
New Hampshire*	14.0	11.4	13.4	21.4	16.2	16.1	4.5
New Jersey	12.4	6.4	14.8	18.1	17.4	12.2	5.2
New York	10.6	5.2	13.0	16.0	13.4	11.8	4.0
North Carolina	16.0	19.5	18.9	14.8	19.7	15.4	8.2
North Dakota*	16.5	10.5	14.8	24.0	24.4	15.5	8.5
Ohio	13.2	12.2	16.6	18.7	15.2	11.4	6.1
Oregon	13.5	9.3	17.4	24.6	14.4	10.5	5.5
Pennsylvania	13.4	9.7	18.3	16.6	16.8	13.8	6.3
Rhode Island**	13.7	8.0	10.3	21.4	20.7	17.7	3.0
South Carolina	15.2	18.6	16.9	18.4	17.1	14.6	5.2
Tennessee	10.4	14.4	11.5	11.4	11.9	8.9	4.5
Utah*	14.0	5.7	13.9	17.5	16.4	17.3	13.3
Vermont*	19.6	27.3	16.3	22.7	21.9	20.0	11.5
Virginia	12.3	15.6	13.7	15.3	15.9	11.1	4.5
Washington	12.8	10.1	13.4	23.6	13.7	13.8	4.7
Wisconsin	15.1	10.1	18.7	16.2	19.0	18.5	6.9
Wyoming	23.3	15.0	32.3	20.4	23.8	27.9	16.7

(Data based on unpublished figures of the U. S. Bureau of the Census.)

* Ratios for each quinquennium from 15 to 44 years based on less than 100 total deaths of females.

**Ratio in quinquennium 15-19 based on less than 100 deaths of females.

We are indebted to Dr. William H. Davis, Chief Statistician for Vital Statistics, U. S. Bureau of the Census, for permitting us to use unpublished figures on the death of females 15 to 44 years of age.

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FIFTY YEARS AFTER FIFTY

A Study of the Duty of the Medical Profession in the Care of Degenerative Disease

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It was my privilege to address the First Race Betterment Conference in 1914, before the outbreak of the Great War. At that time I spoke on "The Prevention of Arteriosclerosis," and suggested forty years of efficiency after forty. I was called to account by the late famous Joseph H. Choate, who said that fifty years after fifty appealed to him, as he was already over eighty. Efficiency after fifty is a problem that cannot be settled by glittering generalities, such as the advice to go slow and be moderate.

I believe that the greatest single advance in knowledge and practice in the prolongation of life after fifty has been in the field of cardiology. If everyone in the world fifty years of age were put under the care of a physician with the object of living another fifty years, what could he do to bring about this result? A physician, as an individual, could do very little to prevent what might be called the accidental causes of death, such as accidents, epidemics and the development of unusual diseases. But the physician could do a great deal to combat the principal life shorteners represented in degenerative disease, particularly in the field of diseases of the heart.

In 1913 there was gathered in London the greatest body of men that was ever assembled in the history of the world. This was the meeting of the International Medical Congress that took place a year before the World War. I have many vivid recollections of delightful encounters with great men, and of impressive meetings and ceremonies, but none stands out more vividly in my mind than the sermon preached by Dean Inge to the assembled physicians in St. Paul's Cathedral. In the opening sentence, which still lingers in my mind, he said, "I greet you as defeated captains. You are always doomed to final failure in your encounters with disease." He then went on to draw a beautiful picture of the character and work of the true physician, struggling with disease, but always doomed to lose his last encounter when death finally claimed each human being, one after another. This sermon must have particularly impressed those whose life work was the care of cardiac disease.

A GREAT CHANGE HAS TAKEN PLACE IN THE TREATMENT OF HEART DISEASE

The most casual observer must acknowledge, however, that during the past twenty years a great change has taken place in the treatment of heart disease. This change represents a fundamental alteration in the point of view of the profession towards the science of medicine. But to understand this change, we must go back several hundred years and observe the pendulum of medical science that has swung first one way and then the other.

Early medicine was highly speculative and founded very much upon tradition and superstition, as was natural to the more simple mental processes of the time. Later, men attained a pride in their own intellect, and very elaborate, dogmatic theories were erected to explain medical observations and to guide the treatment of the sick. Then the experimental method gradually arose, advocating the direct observation of disease. Unfortunately, there also developed a too profound reverence for the study of changes in structure that result from disease; the great pathologists of a hundred years ago were the great men of the profession. Virchow and his contemporaries and predecessors believed that when they had pictured and recorded pathologic anatomy, they had done a very complete task pertaining to disease. When I was a medical student the school of pathologic anatomy had reached its highest development and the great clinicians of the world were the physicians who were greatest in predicting pathologic anatomy as it was later revealed to the eye.

But Virchow founded the cellular hypothesis and this led logically to the study of function. It has seemed to me that I have seen grow up a newer respect for the modification of function as the important element in disease. In the early days the practice of cardiology was most discouraging because it constituted a description of changes in structure. It is rather amusing to recall at this time the amazement of the older professors at the length of time that people lived after their pathologic anatomy had been mapped out and found profoundly altered from the standard for well people. It was a greater surprise when some man in a remote part of Europe or some other place was discovered who went ahead and treated by physiological methods the person who carried this pathologic anatomy, and gave him a new lease of life and a new hope of continued efficiency.

There was literally no pleasure in the practice of cardiology in the shadow of the pathologic anatomist, and a better condition developed only as the modern cardiology grew up with its relatively less emphasis on structure and its relatively greater emphasis on function.

HOW THE MODERN CARDIOLOGIST PROCEEDS TO LENGTHEN LIFE

The modern cardiologist records structure, but carefully differentiates what is the result of compensatory processes and what is the result of fundamental disease. He no longer prates on enlargement of the heart as a great evil. He studies in detail the functions of the heart, and seeks to discover those modifications of function that are beneficent and those that are harmful, and, by an adjustment of the active forces at play in the heart beat, brings about a prolongation of life and happiness that was not possible from the concepts founded upon structure alone. So the modern practice of cardiology is founded upon a study of cardiac function.

The object of this lecture is to outline in a concise form the practice of cardiology by modern methods. We all know that in recent years there has been a great advance in our knowledge of cardiac disorders and that this has been of such practical importance in diagnosis, prognosis and treatment that it should be at the service of every person suffering from a disorder of the heart. Many problems that baffled physicians for centuries have been solved. More and more help is found for the heart sufferer as precise methods are followed. It would be logical to preface this lecture by a review of the knowledge and methods in use before the introduction of graphic methods, but time does not permit and the exclusion must not be construed or laid to a lack of appreciation of their vital importance.

FIVE FUNDAMENTAL FUNCTIONS OF THE FIBERS OF THE HEART MUSCLE

It is just twenty years since MacKenzie completed his great book, "Diseases of the Heart," which crystalized the result of his own work and that of those who went before. In our admiration for graphic methods we sometimes forget the great service done to cardiology by Gaskell, when he formulated the functions of the fibers of the heart muscle. This classification is not by any means perfect or complete, but it is so much better than anything else that it has stood for these many years as a wonderful guide to the understanding of disturbed cardiac function. MacKenzie gave due credit to Gaskell for naming the five fundamental functions of the fibers of the heart muscle as stimulus production, excitability, conductivity, contractility and tonicity.[1]

1. Mackenzie defined these functions of the fibers of the heart muscle as follows:

"By stimulus production is meant the power that the muscle fibers possess of originating a stimulus that can excite the heart to contract; by excitability is meant the power to receive a stimulus; by contractility is meant the power of contracting when stimulated; by conductivity is meant the power of conveying a stimulus from fiber to fiber; and by tonicity is meant that function of the heart muscle that keeps the heart during diastole in a state of slight tonic contraction.

The functions of stimulus production and excitability are most highly developed at the sinus part of the auricle. The rate of the heart depends upon these functions. an increase of their activity resulting in an increase of the frequency of the cardiac action. The activity of the function of stimulus production varies a good deal, as, for instance, the slight acceleration of the heart rate that occurs during inspiration, and the corresponding slowing that occurs during expiration in

BLOOD PRESSURE OBSERVATIONS GIVE INTIMATE ACQUAINTANCE WITH FUNCTIONAL STATE OF THE HEART

Any man who looks upon blood pressure observations as a matter of pure arithmetic by only attempting to record exactly the systolic and diastolic loses the soul of the whole operation. The observation of blood pressure in active practice is one of the nicest procedures in the domain of medicine, and is best carried out by the use of one of the aneroid instruments. After the cuff is applied and the stethoscope is placed over the bend of the elbow, the observer studies the effect of various pressures upon the pulsating vessel. This observation alone, when carried out by one who has done it many thousands of times on many different subjects suffering from different circulatory disorders, gives a very intimate acquaintance with the functional state of the heart and blood vessels. The findings may be recorded as systolic and diastolic pressure, but there is a lot more to it. Nothing is more impressive than to apply the cuff to the arm of an individual and hear through the stethoscope the systolic bruit before any pressure is applied, and to fail to make this bruit disappear no matter how much pressure is applied. This means a high degree of aortic incompetency, and is the first hint of a probable diagnosis of specific disease.

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the young. When excitability is increased, the heart has also a greater tendency to respond to abnormal or irregular stimuli; hence extrasystoles are more likely to occur. While diminished excitability may lessen the heart rate, it should be remembered that slowing of the ventricular rate may be due to other causes, such as depressed conductivity. When stimulus production and excitability are equal, the rhythm of the heart is regular. The pulsus alternans is probably an indication of depressed contractility of the heart. The rate at which the contraction travels from fiber to fiber varies in different parts of the heart. Thus, the impulse spreads in the auricles and ventricles more quickly than it does from auricle to ventricle. In this connection it may be noted that conductivity is observed by estimating the time between the systole of the auricles and ventricles. A lowered state of tonicity results in dilation of the heart and of the auriculo-ventricular orifices.

Immediately after the muscle fibers of the heart have contracted they cannot again be stimulated; in other words, excitability has for the moment disappeared. This is called the refractory stage. Restoration of excitability at once recommences, however, and steadily increases during diastole. When stimulated the cardiac muscle either does not contract at all, or it contracts to be weak or strong. There is, therefore, no relation between the strength of the stimulus and the strength of the contraction; it is a case of "all or none."

The longer the time that has elapsed since the previous contraction, the weaker is the stimulus required to bring about further contraction. Further, the greater the degree of excitability of the muscle fibers, the weaker is the stimulus required, and the earlier in the refractory period will the heart contract. The contractility in the muscle fibers is measured by the degree of contraction. The amount of the contraction does not depend upon the strength of the stimulus employed, but varies according to the time at which the stimuli are applied. When a contraction occurs early in diastole, the contraction in the succeeding cardiac cycle is weaker than that preceding it. Within certain limits, the degree of contractility depends upon the length of the preceding diastole; the greater the period of rest, the more perfect and full is the recovery. It can be readily understood, therefore, that the greater the heart rate the greater is the possibility of cardiac failure. The circulation is carried on most efficiently when the cardiac rate is exactly that which allows the myocardium to recover its full contractility, a rate over or under this being a disadvantage.

Similar laws apply to each of the other special functions of the heart muscle. In the case of conductivity, for example, when conduction occurs, this function has been exercised to the fullest extent possible at the time of stimulation. The refractory period follows immediately after the conduction of a stimulus, and during this brief period the muscle fibers cannot again conduct a stimulus, conductivity being completely exhausted. Restoration, however, quickly commences, and ultimately the function is restored. The extent of the relaxation between the contractions depends upon the degree of tone present, and upon the rate of the heart beat. With a slower rate, there is, of course, more time for full relaxation.

Again, when a very sick person comes under observation and shows no sound in the stethoscope except perhaps between 120 and 140, a very small pulse pressure, one knows immediately that he has to deal with a failing myocardium. The skillful use of the sphygmomanometer is no small part of cardiological observation.

THE FLUOROSCOPE GOES FAR TO REMOVE OBSCURITY

The old adage, "seeing is believing," can be applied to the use of the fluoroscope in cardiology. After observing a great many persons of all sizes and ages suffering from many different cardiac troubles, personal skill in observing and interpreting is acquired and goes very far to remove the obscurity of cardiac disease.

Combined fluoroscopic, radiographic and orthodiagraphic examination of diseased conditions gives evidence of the nature of affection through the occurrence of changes in the character of the pulsation, the position of the heart and the size and form of its outline.

In fluoroscopic examinations the lower right border (right auricle) expands extensively during systole in some cases of tricuspid regurgitation. The upper left border (aorta) gives strong systolic expansions in the aortic insufficiency. Whenever the pulsations of the left auricle become visible, as in mitral lesions, they are differentiated by being presystolic in time. Strong pulsations of the pulmonary artery are evident on the left side in cases of persistent ductus arteriosus, or more frequently when a severe stasis due to mitral lesions is present. They have been observed when an aneurysm ruptures into the pulmonary artery, but this event is rare. Abnormal rhythms, as heart block and pulsus alternans, have been studied and diagnosed by fluoroscopic methods, but this procedure possesses no obvious advantages over auscultation.

VARIATIONS IN POSITIONS OF THE HEART

A change in the position of the heart may occur from congenital causes, as *situs inversus viscerum,* from pleural and pericardial adhesions, or from changes in the introthoracic volume. These last are very common. Even normal variations are caused by the varying position of the diaphragm. In long-chested individuals the cardiac shadow is long and narrow, the axis being more vertical, while in short-chested individuals or in those in whom the diaphragm is pushed up by abdominal distention, it is broad and assumes a horizontal axis. Its position changes as the diaphragm ascends and descends in respiration. It should be remembered that normally the heart is subject to considerable shifting, and undue weight should not be attached to slight variations in position. If for any pathological cause, such as enlargement of the liver, the right dome of the diaphragm is pushed upward, the

heart shadow will be displaced to the left. Pulmonary affections, such as atalectasis, tuberculosis and pneumothorax, cause a traction on the heart toward the side of the lesion. On the contrary, pleural effusions, tumors, etc., push the heart toward the opposite side.

SHADOW SIZE CHANGES IMPORTANT

Changes in the size of the heart shadow or orthodiagram, when sufficiently marked to be safely beyond the limits of normal variation, are of the greatest practical importance when obtained by guarded technique. The heart shadow probably decreases whenever the heart accelerates, such as in exercise, tachycardia, after atropin, although the results obtained concerning this point have been discordant. During asthmatic attacks the heart is also reduced in size. A condition simulating asthma, as far as the effect upon the circulation is concerned, can be produced by the well known experiment of Valsalva, which consists in taking a deep inspiration and then, with closed glottis, making a forced expiration. This diminishes the blood content of the heart, which accounts for its decreased size. In tuberculosis the shadow is decreased, and here it is often assigned—but without good reasons—to an actual hypoplasia of the heart muscle.

The heart outline increases after continued hard labor or exercise, pathologically also in nephritis and arteriosclerosis. In these cases an actual hypertrophy resulting from the greater strain to which the heart has continually been subjected is usually the cause. The increase in size (often temporary) associated with acute infections such as diphtheria, scarlet fever and polyarthritis is no doubt accounted for by a dilatation of the heart.

The details of the enlargement are of the greatest importance in heart lesions, in which case it is due either to dilatation or to hypertrophy and hence accompanies only lesions of considerable duration and severity. The nature of the dilatation or hypertrophy determines the direction of the enlargement and the contour of the shadow. A left ventricular enlargement takes place to the left. Dilatation or hypertrophy of the right ventricle displaces the shadow partly to the right, but also, to a marked degree, upward and to the left. In typical of aortic insufficiency, the heart shadow is enormously increased toward the left and the contour resembles a horizontal oval or is sometimes called "shoe-shaped". The aortic shadow is increased in width and the apex is never merged with the shadow of the diaphragm. Aortic stenosis causes very similar though less pronounced changes in the radiographic outline. In mitral stenosis the heart shadow, which is relatively small, resembles more nearly a vertical oval. The enlarged left auricle becomes prominent on the left margin and above it the

pulmonary artery bulges, thus giving the entire left border a step-like appearance. In mitral insufficiency the enlargement tends to be uniform in all directions giving the shadow the appearance of a poorly rounded circle. The right auricular border is distinctly enlarged to the right and the pulmonary artery dilated. The left ventricular shadow is increased toward the left.

CHANGES IN CARDIAC FUNCTION OBSERVABLE BY THE ELECTROCARDIOGRAPH

For the benefit of those of my audience who are not cardiologists, I pause a few moments to give a simple, popular description of the findings of the electrocardiograph and the polygraph that I have used on numerous occasions, hoping to break the ice and induce others to take up the study.

The electrocardiograph has given us methods of recording cardiac function that were undreamed of in the olden days, and while a single observation is of vast importance, our real satisfaction comes in observing by the electrocardiograph the changes in cardiac function over long periods of time.

When a physician is reading a book and meets a line of a foreign language, such as Sanskrit or Hebrew, he can skip it with a clear conscience because he is not expected in his professional capacity to know what it means. But the time is soon coming when any man who skips an electrocardiogram that is used in the description of a heart condition will display a lack of professional knowledge that will be inexcusable.

It takes about three months of hard study to grasp the essential points of electrocardiology, but these three months could be distributed in parts over as many years if the physician would only make a beginning. The great trouble that comes at the very beginning is that the electrocardiogram does not correspond with the ordinary description of the heart beat as consisting of systole and diastole, nor does it correspond with the sound of the heart described as the first and second sound.

The description of the heart beat as consisting of systole and diastole is entirely inadequate as showing what really takes place. As regards the sounds of the heart, it is found that auricular contraction does not make any sound, nor does the ventricular contraction make any sound except at its beginning. So it is much better, in attempting to read the electrocardiogram, to forget all that has been learned about the heart action and about the heart sounds and the so-called cycles of the heart and to start all over again.

In the electrocardiogram we have a record of everything in the nature of muscular activity that takes place in the heart. The most casual inspection of the electrocardiogram of a healthy person reveals three principal events:

Figuratively speaking, from left to right, there is a little mound, a church steeple and a small mountain. This church steeple is always present, though the style of its architecture may vary a good deal. The mountain is also present in all electrocardiograms, but the little hill is absent or displaced a good many times. The little hill represents the contraction of the auricle, the church steeple represents the sharp contraction of the ventricle on its contents, and the mountain represents the squeezing of the contents of the heart into the circulation. So, in reading the electrocardiogram the first thing to look for is the church steeple; then walk back a little and look for the mound; then return past the church steeple and inspect the mountain.

The little hill is called the P wave. The church steeple or spike is called the R wave, and the mountain—representing the work of the ventricle—is called the T wave. The letters P, Q, R, S, T, U were arbitrarily used to name the different waves that are found in the heart. The Q wave is the downward wave following the upward P wave, and the S wave is the downward wave of the upward R wave. P, R and T are the principal letters; the others receive scant notice in ordinary clinical work.

I wish somebody would strike a simple mnemonic for remembering these things. Perhaps the idea of passing a little hill, then coming to the church at the foot of the mountain will do to remember the waves, but how to fix the letter P as belonging to the hill and the letter R as belonging to the church, and the letter T as belonging to the mountain, I do not know. Perhaps if you try to contrive some way of remembering you will think so much about it that it will not be necessary to have any way to remember it.

HEARTS WRITE AUTOGRAPHS IN A GREAT VARIETY OF SIGNATURES

After we have learned to recognize the wave of the auricle, and the wave of the ventricular contraction, and the wave of the ventricular work, then we come to the study of the electrocardiogram of a healthy heart. Just as in handwriting, so hearts, in writing their autographs, make a great variety of signatures, but the outstanding characteristics in healthy people show the auricle always beating in a regular specified time before the ventricle, and the ventricle taking a specified time to complete its work, and these things recurring regularly without interruption.

THE SEVEN VARIETIES OF IRREGULAR HEART

There are seven varieties of irregular heart, and a friend of mine the other day did strike a trick for remembering these that, though rather clumsy, may serve our purpose. He said, remember the word "ships" and then three A's. Leave out the I in "ships" and we have SHPSAAA.

S stands for sinus arrhythmia; H for heart block; P for premature contractions; S for simple paroxysmal tachycardia; A for auricular flutter; A for auricular fibrillation; A for alternation in the pulse. My friend also suggested that we should memorize the letters of the second word, but I confess that I have not been able to do it. I have found the "ships AAA," quite a help when all of a sudden I have to recall this list of irregularities.[2]

THE RELATION OF VITAL CAPACITY TO HEART IMPAIRMENT

Vital capacity constitutes an additional resource for observing a person subject to heart disease. We have been using it in the last few hundred cases, but have not formulated an independent judgment as to its application. It is a very definite fact, however, that reduced vital capacity is a strong indication of impaired cardiac function and that it varies with the condition of the heart.

DRUGS USED BY THE CARDIOLOGIST

In spite of all modern tendencies to the contrary, drug treatment still constitutes a most essential element in the practice of cardiology.

2. In sinus arrhythmia, we find the beats of the heart all right, but the beats do not come at regular intervals, the space between them growing gradually broader and then gradually shorter as the pulse is observed over a short period of time.

In heart block we find either a lengthened distance between our little auricular hill and our ventricular church steeple, or we find the distance between the hill and the steeple different in every beat. The former means that the impulse of the heart is delayed between the auricle and the ventricle. The other means that there is no impulse conveyed from the auricle to the ventricle and each beats at its own individual rate.

In premature contractions we have a very peculiar state of affairs that makes a most extraordinary picture. We have a very large church steeple, often turned upside down, and a very large mountain also often upside down, but when we come to look for our little mound, it is entirely absent. This means that the ventricle of the heart has undertaken to beat by itself, not waiting to receive its cue from the auricle. The reason that the beat is upside down is that the ventricle started to contract at its apex instead of at its base, thus reversing the electric current.

In simple paroxysmal tachycardia, we find the beats of the heart very numerous and crowded together, so that very often our auricular mound and our ventricular mountain come together and the hill is lost in the mountain. That means that the auricle started to beat before the ventricle was through beating. At other times the beat is natural enough in its hill, its church steeple and its mountain, but there is no interval between the beats.

Auricular flutter is just what its name implies, that is, a very rapid beating of the auricle like a struggling bird held in your hand. It produces a large number of little mounds that are distributed at regular intervals throughout the electrocardiogram, but at the same time the ventricle is beating and producing its church steeple and its mountain. Sometimes there is a church steeple for every two mounds and sometimes the church steeple and the mounds come irregularly. Often there are three hundred mounds and one hundred and fifty church steeples produced every minute.

In auricular fibrillation our auricular mounds are entirely absent, and are replaced by something that looks like a ploughed field and the church steeple and mountains are present in greater numbers but are absolutely irregular in their arrangement. This means that the auricle is trembling and not contracting, being paralyzed.

I have taken the time to give this simple ABC introduction to electrocardiology because it seems to me that the great stumblingblock in the whole matter is that people do not make a beginning in this study. It is a most fascinating field of work, and I am sure it will well repay in pleasure and usefulness the effort expended to become familiar with it.

The development of individual practice is from the complex to the simple. Every physician starts medical life with his mind stored with information as to a vast number of remedies. Twenty-five years later he has selected, according to his own training and experience, a much fewer number of drugs, which he applies with infinitely more skill than he did at the beginning.

Paints and brushes are the tools of the artist. The tools of the physician are drugs. Any one can supply himself with brushes and paint, although when he has selected the proper brush and the proper paint he has not gotten very far toward painting a picture. In the same way, the cardiologist, when he has selected the proper drug and has decided upon the combinations in which it is to be administered, has not gotten very far towards the curing of the sick person. Everything depends upon the constant adaptation of the remedy to the immediate and future needs of the individual.

Drug treatment might well occupy the whole hour and many more hours besides, but I will limit my consideration of the subject simply to an enumeration of a few drugs that I find especially useful in actual practice. If I neglect to give this subject the time that it merits, it is because of its ancient standing that makes emphasis of it unnecessary.

DIGITALIS

In defense of the limited number and precise form of these drugs, I would say that I have always regarded a man's practice as an experimental field in which the office is the laboratory. The more precise and uniform the methods used, the clearer are the teachings of experience. No man prescribing many different forms of digitalis, for many different people, under different circumstances, can draw nearly so valuable a set of conclusions as he who uses exactly the same preparation as to strength and unit of dosage under all conditions. For that reason I adopted, under the influence of Professor J. M. Groedel of Bad Nauheim, a half grain digitalis tablet as a unit of medication, and have stuck to it, with the result that I have been able to predict, at least in my own practice, about what the reaction will be under various conditions and circumstances.

The choice of this unit was founded upon the fact that three of these tablets in a day, equaling a grain and a half of digitalis, is the average maintenance dose. I have expounded this to each one of the army of detail men who have come to me from drug firms and each one has always been very much impressed and said he would go back to his firm and have them make up this half-grain digitalis tablet. Only within the last few days has my propaganda borne fruit, for I

received a circular from Burroughs-Wellcome that they had agreed with my reasoning with regard to the half-grain unit of digitalis and that they would make and dispense the half-grain tablet of the leaves. The grain-and-a-half unit of the average proprietary digitalis preparation is entirely too large. It is like a mechanic having nothing in his kit of tools but a great big monkey wrench that would not lend itself to fine adjustment for any real delicate mechanical operation. For these reasons the half-grain tablet is my choice of a unit of medication in digitalis.

QUINIDINE

I will mention only five drugs. The next one is quinidine. Here, again, the druggist does not give us a satisfactory tablet, if indeed he gives us any tablet at all. I use a two-grain tablet that is of much value as a heart sedative in the minor functional disorders. I refer you to an article of mine published in the *Medical Journal and Record* of July, 1927, page 25, "The Value of Quinidine Sulphate in Cardiology." I think quinidine is one of the best things we have had added lately to our resources in treating heart cases.

THEOBROMINE AND SODIUM SALICYLATE

The third remedy is theobromine and sodium salicylate (Merck). I use the five-grain compressed tablet, with definite instructions that it should be taken after meals as fully as possible dissolved in half a glass of water. You cannot give satisfactory doses of this remedy unless it is well dissolved in water because it has an irritative action on the stomach when it reaches the lining in concentrated form. I have found this a very important point in the use of this most valuable drug. In five-grain doses three times a day, taken over long periods of time, it is of much use in eliminating the occurrence of angenoid attacks. I have already referred often to Professor J. M. Groedel of Bad Nauheim. This is because I studied so much with him and got so much valuable information from him. It was he who taught me the use of this drug in this way.

NITROGLYCERIN

The fourth remedy is nitroglycerin. Here, again, we are up against the difficulty of unsatisfactory preparations. At least one great drug firm no longer makes tablets because they find it utterly impossible to keep them satisfactorily. My own solution of the problem has been to have granules representing 1/225 of a grain made with a solid coating. These, I know, retain their strength for long periods of time because a good many people, with recurrent angenoid pain, test them practically every day. In these small doses nitroglycerin is a very

useful remedy in almost any cardiac emergency. It never does any harm and relieves many symptoms even where it is hardly possible to explain the reason. So it is my custom to have nearly all people with important cardiac impairments carry a small phial of these granules for use in any emergency.

THE BENEFICIAL USE OF CASTOR OIL

The fifth remedy, without which I would not care to practise cardiology, is castor oil. I try to train all cardiopathic individuals to take a full dose of castor oil at least once a month. It is an insurance against the intestines becoming a depository of residual food matters. Many people enjoy a sense of well-being after the monthly dose of castor oil. In the face of very serious cardiac impairments I have found serial doses, say an ounce every other day for three doses, a very useful approach, particularly where saline elimination has been previously abused. The constipation following castor oil is of advantage in the restoration of circulatory tone in some "down and out" individuals.

CARDIAC AND GASTROENTEROLOGICAL FUNCTIONS INTIMATELY ASSOCIATED

The relation between cardiology and gastroenterology is so intimate that if you scratch the skin of the cardiologist you will find underneath a student of gastroenterology. Cardiac function and gastroenterological function are so intimately associated that the medical mind cannot consider one without the other and the layman often confuses the two. I honestly think more people suffering from functional cardiac pain go to the gastroenterologist than to the cardiologist during the early stages of their complaint.

PSYCHOTHERAPY IMPORTANT IN HEART DISEASE

In mentioning psychotherapy I do not wish to imply that we are in any sense suggesting its formal adoption in cardiology as it has been adopted by the neurologist, but I do think it must always be considered as an important element in dealing with the heart sufferer. There are some principles of psychotherapy that we cannot get away from. In the first place, the minute we indulge the vice of prophecy of evil, in allowing ourselves to fix even the idea of a failure of our efforts to cure, we defeat the possibility of a successful psychotherapy. So prognosis must be, in a large measure, eliminated by the man practising cardiology. I say to people, "I hope and believe that my efforts will be successful in helping you. I do not know what the outcome will be. I have seen people much sicker than you are do very much better than anybody had a right to expect." Dealing with the fear of death is a

matter depending upon the personality of the physician. Personally, my method has been to acknowledge frankly the danger of sudden death in serious cardiac disease. I say, "It is true, you may die suddenly, but of the great multitude of people with heart disease the number who die suddenly is very, very small. The sudden death of a prominent person on a golf course is advertised in every paper in the United States, and yet this happens only once in a few months. I cannot assure you that you will not die suddenly. I want you to accept it as a possible fact and then forget it."

This method of meeting the situation may be a matter of personal success on my part, but it has always worked very well and I never hear again an expression of the fear of sudden death. If I attempted by prevarication and dissimulation to conceal danger that is a fact, I believe that the situation would naturally be aggravated. Here I must leave the subject of psychotherapy.

EXERCISE MOST BENEFICIAL BEFORE THE WORK OF THE DAY

When I say that physiotherapy was the thing that led me to devote myself to cardiology, it is easy to believe that it has always been a matter of the greatest interest to me. At the very beginning of this line of work I went to Bad Nauheim and studied the methods there, and I think I absorbed certain principles that have been an influence ever since. Physiotherapy involves the training of people as to exercise. My favorite prescription for heart sufferers is to walk out-of-doors before twelve o'clock in the day, up to the point of fairly definite physical fatigue. The principle that exercise should be taken before the work of the day and not after is an important one. The business man who attempts to take exercise after his day's work does not get much benefit from it and usually gives it up. The man whom you can persuade to take exercise in the early morning gets the real benefit. Baths, exercise, light and electricity must all be considered, but cannot be gone into here at length.

I first became interested in cardiology through the work of men who were decidedly outside the pale of the more conventional group of physicians, men who at that time were under the cloud that then hung over the practice of physiotherapy. Most conspicuous among these was Dr. Schott of Germany and Bezley Thorne of England. These men held out hope to the heart sufferer.

CARDIAC LESIONS MODIFIED BY RE-ADAPTATION TO CAPACITY AND SURROUNDINGS

A great resource in modifying the outcome of a cardiac lesion in any individual is re-education, the training of the individual to adapt

himself to his capacity and surroundings. I prefer to treat people without removing them from their usual surroundings. A person cured without transplantation is in a much better position than a man who is sent away and then must come back to take up the burden of life. It is much easier in every way, of course, to re-educate a person if he can go away to a cure resort. Much benefit is obtained by people who go to Europe for this purpose. Up to the present time we have no well developed cures in this country.

THERE ARE DIFFERENCES IN PRIVATE AND PUBLIC PRACTICE

I wonder how many of you have ever considered the great difference between private and public practice in cardiological work. By public practice I mean all that work done in hospitals, dispensaries and teaching institutions. By private practice I mean work that is carried on with people with whom the relationship of private physician is established. In public practice one encounters a group of people many of whom have developed heart disease under conditions of irregular living and the strain of continuous labor or who have lived under bad hygienic conditions, also a group of people who as a rule do not regard minor discomforts and who are in a great measure fatalistic in their outlook upon life. In private practice we often have just the reverse. We have people who develop cardiac disease under conditions of luxury and indolence; a group that do not disregard any personal discomfort and who can and will carry out any reasonable plan of treatment or change of environment. In the former group severe organic disease is very conspicious. In the latter group functional disorder predominates.

Then, of course, the man who draws his experience chiefly from charity hospitals must constantly have a great deal to do with the end results of an unsuccessful attempt to adjust heart sufferers to their environment. In public work the personal relationship of the physician, which carries with it an unconscious but helpful psychotherapy and the details of adjustment of diet, exercise and education in the use of drugs, is lacking. There are many individuals in the public practice group who are invalids on account of the lack of adjustment, but who, in the private practice group, would pursue active and useful lives.

THE SERIOUS HEART PROBLEM IS A "ONE-MAN PROBLEM"

The practice of cardiology that I am attempting to describe at this time pertains only to the private practice group. Success in the treatment of the cardiopathic person depends upon personal relationship, in a great measure. This was very much impressed upon me when a member of the family of one of our greatest physicians, the late Dr.

Delafield, came under my care one summer and by a great deal of detailed attention I was fortunate in improving her condition. This happened in the summer, a long distance from New York. When I returned in the fall I expected, of course, that Dr. Delafield would become the principal adviser of his cousin of whom he was very fond. He reviewed the whole situation and finally when I met him he said, "I want you to go on with this case. I will give you every help that I can, but it is a one-man case and I think that my cousin will do much better if I do not treat her." This taught me a lesson in the practice of cardiology, that a serious heart problem is a one-man problem and, valuable as the consultation and conferences are, the heart patient himself is much better for the well considered and well advised counsel of a single physician.

If therapeutics were a definite, clean-cut science, it might be directed by a jury, but the man who has developed a therapeutic sense often wishes to do things that he feels to be best but that he would not do if they could be done only after the effort of persuading a jury of physicians to agree with him. The good therapeutist often wishes he could give a single dose of a remedy to study the reaction of the person in his charge, planning his next dose upon the effects of the first dose, and so on. This is impossible when working with a jury.

Public cardiology is the practice of cardiology carried on in front of a jury, and in large institutions a pretty large jury at that, including nurses, doctors, students, other patients in the ward and friends and relations.

The heart patient treated by one good doctor gets full and adequate treatment. With two doctors, he gets what those two can agree upon, and I have never yet seen an adequate, complete therapeutic plan come out of a conference of half a dozen consultants. The best results, when the physician finds himself insufficiently trained for the care of his patient, are reached when he succeeds in associating with him a cooperating consultant who carries the case along with him and the two, together, work out a continuous and logical plan. The time element in assimilating all the points of a difficult medical problem is important, and the second conference in a serious case is often much more productive of results than the first.

HEART PATIENTS REQUIRE CONTINUOUS CARE

The proper practice of cardiology involves the continuous care of people. It has no place, to my mind, in that type of practice that constitutes prescribing for people for the cure of what ails them at the moment merely for the relief of symptoms. This type of practice is demanded by the masses and necessarily the legitimate activity of

many practitioners must be ruled out entirely. There is no use in attempting to do good work in cardiology except under conditions of continuous observation. The true cardiologist is a very poor consultant. He cannot work quickly enough or complete his task at one interview well enough. In a single interview, consultation is much better carried out by the general medical internist. If the cardiologist is employed in a case, he should be employed for continuous association. Otherwise, he is pretty much wasted. A follow-up of patients according to the methods recommended by many good thinkers and set forth, not long ago, in a pamphlet by Dr. Niles of the Cornell Clinic is a great help.

HEART, BLOOD VESSELS AND KIDNEYS SHOULD BE CONSIDERED AS PARTS OF ONE MECHANISM

In this sketch of the practice of cardiology as it has grown up and developed, it has been necessary to omit all consideration of the theories and care of arteriosclerosis and of the many frequently occurring complications that come to the cardiopathic subjects. In general, however, it still seems that better results are accomplished all round when heart, blood vessels and kidneys are considered as parts of one mechanism, which cannot be considered apart from the brain, stomach and general nervous system. Everything must coordinate, with due regard to the personality of a man or woman whose life, health and happiness are to depend upon our efforts.

THE DISEASE OF DISEASES

The Basis of the Treatment of Stasis

Sir W. Arbuthnot Lane, President The New Health Society, London, England.

In considering the treatment of stasis, it is absolutely essential that we become familiar with its causation.

The factors determining the series of the mechanical and toxic conditions with the complications that follow upon them depend on a general law, namely, *"that we bear a simple mechanical relationship to our surroundings. Any change in that relationship results in corresponding alteration in our anatomy."*

To this law there is the corollary *"that anything that nature does to help us to meet an altered mechanical relationship to our surroundings tends to shorten our life."*

In this communication it is not necessary to demonstrate again the truth of these laws, since I have done so very often during the last forty or more years. I was able to formulate these laws by the study of the changes that the bones and joints undergo when any very laborious occupation has been followed for many years. These laws apply equally to the soft parts of the body as well as to the framework.

THE NORMAL SEQUENCE

In native life the individual evacuates the contents of the large bowel automatically at an interval after every meal. Naturally in infancy when the child is nourished on frequent occasions the evacuations correspond in number and are many during the twenty-four hours. Later in life when the individual consumes only two meals in the twenty-four hours, he has two evacuations, when three meals, three evacuations. These evacuations are abundant and formless, since the meals are also very bulky. That this sequence was recognized as being the normal by the ancient Greeks is well illustrated by the teachings of Hippocrates, who insisted on its extreme importance to health and to freedom from disease. In civilization it is unfortunately the custom to have only one evacuation a day. That usually takes place in the morning, but the time varies with different individuals. During the period that the human infant wears napkins or diapers, it evacuates its bowel with a regularity or irregularity that varies with the perfection of the mother's milk or with that of the artificial products that in our degenerate state are provided by the food chemist to replace the normal food of the infant. When, however, the mother discards the use of the diaper, she teaches the child to control the normal impulse

to evacuate the bowel after each meal and to retain the faecal matter in the intestines for twenty-four hours. She considers that once a day is sufficient for health. This process of education is spoken of as the *"regulation of the child's bowels."*

What does the mother do as the result of destroying the normal habit of emptying the large bowel after each feed? She insists that the end of the large bowel, which has been evolved through the ages to contain an amount of faecal matter corresponding to the input, shall accommodate the result of twenty-four hours' digestion.

BANDS FORM TO MEET ABNORMAL COLON TENSION

Should she be successful in this, the terminal segment of the colon would have to become sufficiently dilated and elongated to hold all this material. It is obvious that should such a result ensue and the process of elongation and distension increase, as time went on it would form an insuperable or almost insuperable barrier to the passage of solid material through it.

To oppose the development of this abnormal mechanical relationship, nature crystallizes bands or membranes along the lines of tension. These secure and shorten up the mesentery and later obtain a hold upon the bowel itself. As we all know from the observation of fractures, the changes that take place in early life are infinitely more extensive and rapid in their development than those of later life. Consequently the earlier the development of the stagnation of the contents in the colon because of the enforced control, the more extensive are the bands that form to meet this unnatural relationship. It is because of this very early and rapid development of the crystalization of these lines of resistance that many who took at one time a view different from mine as to their origin imagined that these membranes were congenital in origin. This is due to a want of familiarity with the laws formulated by me and upon which evolution and stasis are based.

INTESTINAL AUTOINTOXICATION CAUSE OF PROGRESSIVE DEGENERACY

It is hardly necessary at this period of the world's history to enumerate and to describe all the mechanical and toxic changes that ensue because of the development of the progressive interference with the function of this segment of the large bowel, and of the symptoms and diseases that arise because of it. They are now all generally recognized by practically every branch of the profession, and intestinal autointoxication, once an object for ridicule, is now regarded as the cause not only of all the diseases of civilization but of the progressive degeneracy of peoples who live in what is called a state of civilization. Since the native living in his normal surroundings and enjoying health and vigor to an extent unknown to us is quite free from these diseases, they may

truly be called the *diseases of civilization.* Dr. Victor Panchet speaks of them as being due to constipation, which he justly calls *"the disease of diseases,"* since it is the cause of the vast majority of our illnesses. As it is due to an infection of the contents of the small intestine by organisms that ascend from the colon and invade those contents, I prefer to call them *"filth diseases."*

IMPORTANCE OF EDUCATING THE YOUNG

Having realized the cause of these diseases, it devolves on us to instruct the young, and especially girls, in the importance of evacuating the bowel after every meal. This should be made clear to mothers generally in order that they may not handicap children during their life time by inculcating a dangerous and degenerating habit. Again, women should be urged so to attend to their health that they may become capable not only of producing children of good sound physique but also of nourishing them by means of their own milk for a sufficient length of time. Much can be done by instruction on diet, habits and exercise, most of which forms no part of the education of the young at the present time.

The whole object of the State being to deal with end-results through the medical, political, legal and clerical sections of the community, practically no pains or trouble are taken by those in authority to remove the source of all our degeneracy and disease and crime. For this reason the medical profession should exert itself in the cause of *prevention,* since it is the only means by which we can reduce ill health and disease, and improve the happiness, prosperity and well-being of the community. For, without a thorough knowledge of the mechanics of stasis, an incalculable number of operations are performed, many of which are quite unjustifiable and useless.

Salus populi suprema lex esto

THE ALARMING INCREASE IN THE MORBIDITY AND MORTALITY OF TUBERCULOSIS AMONG YOUNG WOMEN

S. Adolphus Knopf, M.D., Formerly Professor of Phthisiotherapy at New York Post Graduate Medical School and Hospital

In the preparation of an article on "The Essentials in the Prevention of Tuberculosis in Infancy and Childhood,"[1] I had occasion to observe that there now exists a relatively greater mortality from tuberculosis among young girls between 16 and 19 years of age than among boys of the same age. This situation was revealed by our New York statistics for the years 1924 and 1925. More recent figures show that the condition has not improved but has grown worse.

I have since learned that in other large cities there has also been observed an increase in the morbidity and mortality of tuberculosis among young women.

The exact morbidity is, of course, rather difficult to ascertain. Formerly we counted eight tuberculous patients living to every one death from tuberculosis. Thanks to the improvement in early diagnosis, hygienic measures, public education and better economic conditions, the rate is now reduced to six cases of morbidity to one death, with a concomitant decrease in the death rate. It is obvious that among young girls still at work, many early and ambulant cases must exist, and that there must be an increased morbidity with the increased mortality. This becomes evident from the report of Dr. Dearholt, who a few months ago stated that, for the first time in the history of the Wisconsin Tuberculosis Association, all the state's twenty sanatoria were filled with patients, with long waiting lists at many of them, this situation being due to the increase of tuberculosis among young women.

Mrs. James Edward Newcombe, Founder and Chairman of the Board of the New York Stonywold Sanatorium for young tuberculous working women, writes me that my statement with regard to the increase of tuberculous diseases in young women is, in her estimation, borne out by the fact that in spite of the increase in the capacity of the institution there has not been a single vacancy during the last three years and the sanatorium has a long-standing waiting list.

This is not the case with other public institutions not exclusively for the treatment of tuberculosis in young women.

In response to my inquiries, Dr. Wade Wright, the Assistant Medical Director of the Metropolitan Life Insurance Company, who attends

1. Knopf, S. A.: "Essentials in the Prevention of Tuberculosis in Infancy and Childhood." Journal A.M.A. Vol. 88, pp. 1058-1060, Apr. 2, 1927.

to the examination of all applicants for employment in the Company, made the statement that nearly eight per cent of the girls applying for positions have to be rejected on account of tuberculosis. They are the strongly suspicious or slightly incipient cases.

HIGHER MORTALITY AMONG GIRLS THAN AMONG BOYS

Concerning the actual tuberculosis mortality among young women, I was fortunate enough to obtain, through the courtesy of Mr. J. G. Drolet, of the New York Tuberculosis and Health Association, accurate and recent statistics, which show that, for last year, the mortality from tuberculosis among girls between the ages of 16 and 19 is now nearly twice as high as among boys. In the year 1926 in New York City, there died from all forms of tuberculosis 257 girls and only 139 boys, between the ages of 15 and 20; and 369 women and 293 men between the ages of 20 and 25.

In Baltimore the tuberculosis death rate among the female white population between the ages of 15 and 19 during the years 1910-1926 was 145 for 100,000, while in the males at the same age it was 115. Between the ages of 20 and 24, the difference was still more pronounced, being 235 in the female and only 180 in the male.

Concerning the death rate in Cleveland, Howard W. Green[2] makes the following report: "Because so large a percentage of the female deaths between the ages of 15 and 30 years are due to tuberculosis, and because of the fact that between 1910 and 1926 a similar reduction to that of the male was not experienced in the female death-rate for the age groups 15 to 19 and 20 to 24 years, concentrated efforts must be directed toward the consideration of the causes and prevention of tuberculosis with special reference to girls between 15 and 25 years of age.

"The death rates for the male and for the female between 15 and 25 years of age are much the same up to the year 1918, but since that time the male death rate has decreased much more rapidly than the female death rate. This reduction has placed the male death rate at the present time lower than the female death rate. The average female death rate of 124 for this age-group for the years 1910 to 1914 was reduced to 106 for the years 1922 to 1926, a decrease of 14 per cent, while the male death rate of 133 was reduced to 64, a reduction of 52 per cent, during the same period."

REASONS GIVEN FOR INCREASED MORTALITY

In view of our claims that the general morbidity and mortality of tuberculosis has been decreased by more than 50 per cent during the last

2. Green, Howard W.: "A Graphical Analysis of the Trends in the Tuberculosis Death Rate." Printed by Cleveland Health Council. 1927.

35 years, these comparative reports are decidedly depressing. Dr. Dearholt describes the increased mortality among girls between 15 and 25 to the flimsy modern dress and he thinks that the mortality from tuberculosis among young women would be cut down if we could push dress reform. There is no doubt that Dr. Dearholt is right in his belief that insufficient protection of the body by suitable clothing is in a measure responsible for the contraction of so-called "colds," due to invasion by the micrococcus catharrhalis, the influenza or the pneumonia germs, and that the field for the ubiquitous tubercle bacillus is

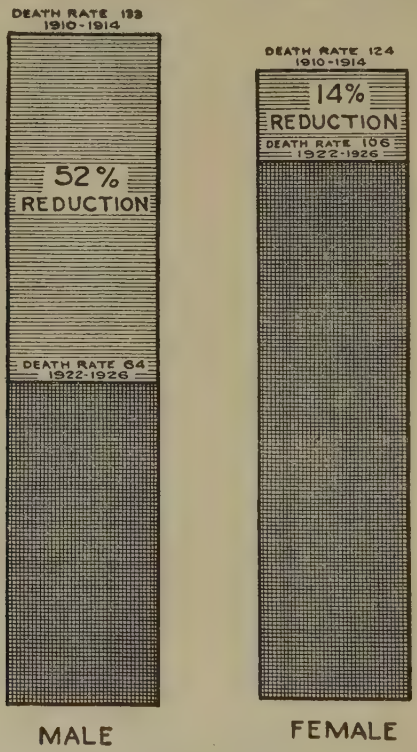

FIG. 1.—CHART OF CLEVELAND MORTALITY STATISTICS

A comparison of the reduction of the male tuberculosis death rate per hundred thousand with the female rate for the age group 15-24 years between 1910 and 1914 and 1922 and 1926, at Cleveland; white.

thus prepared. I believe, however, that besides this lack of protection of the body by insufficient clothing there are other reasons for the increase of tuberculosis among young women.

There is, first, the almost insane desire of so many of them to have a slender figure. To attain a boyish appearance, they will voluntarily submit themselves to actual undernourishment. Very many of those who have fallen victims to tuberculosis have been hard-working em-

ployes in factories, workshops or offices, with good appetites, but who in order to lose or not to put on weight content themselves with an ice cream cone, a cup of coffee, or a sandwich at luncheon time, hastily swallowed. They do not make up by a substantial breakfast or a good dinner for what they have missed at luncheon. The result is inevitably a strong predisposition to, if not the rapid development of, a hitherto latent tuberculosis.

Besides the scanty dress of light material with insufficient undergarments, there is the tightly laced brassière, or the wide elastic band tightly adjusted over the breasts to increase the boyish appearance, and the stooping attitude particularly affected by high school and college girls.

The compression of the mammary glands may endanger their function when the girl becomes a mother. These girls are often afraid to take a deep breath for fear of developing their chest, or their mammary glands. The almost inevitable result arising from constant compression of the breasts, is the inability of the young mother to nurse her child, which is a far more serious matter than seems apparent. We are having less breast-fed babies than ever before, particularly among the better and middle classes, largely because so many young women are ashamed of well developed mammary glands. Perhaps if they knew that the breast-fed baby withstands infantile diseases many times better than the artificially fed baby and that the breast-fed child will make a healthier and stronger man or woman than the one deprived of the privilege of being naturally nourished, the motherly instinct, which exists in all normal women, would make them realize the folly and danger of compressing their breasts. To nurse her child herself, if she is healthy, is not only the most natural physiological function and conducive to the health of both mother and child, but it may well be considered a patriotic duty for the mothers of the future American generation. They should also bear in mind that well developed breasts are an addition to a graceful figure.

DANGERS OF INSUFFICIENT CLOTHING

While the present mode of dress has advantages over many of the modes of the past—the wasp waist, the long trailing skirts, the many petticoats, heavy flannel underwear against which I preached in my first paper before a medical society many years ago[3]—extremes should be avoided in either direction.

The moderate exposure of throat and upper anterior portion of the chest may not be at all injurious and may perhaps even be advantageous

3. Knopf, S. A.: "Dress Reform in its Relation to Medicine," Sou. Cal. Pract. Vol. IV, p. 345, 1888.

in hardening the system against "contracting colds" (our sailors dress similarly in the coldest weather), but the exposure of shoulders, arms and limbs is doubtless often responsible for chilling the body in cold weather; and the style of evening dresses worn by women of leisure and also by working girls is doubtless responsible for many a bronchitis or more serious pulmonary trouble. These modern evening dresses are not only décolleté in front, but very often they expose nearly the entire length of the spinal column with its relatively thin covering of muscular layers. As long as one remains in a warm room when so much of the body is uncovered, there may be no harm in that style of dress. There is great danger of being chilled, however, when going into the outer corridors to cool off after being overheated by dancing. The flimsy scarf worn by some is only an imaginary protection.

While there is no excuse for the altogether too flimsy dress, the employer expects that the girls be neatly and stylishly dressed in his office; and the desire for appearing pretty and attractive is also naturally inherent in every woman. The employer should bear this in mind in considering the wage of his workers. It would seem, however, that for the same or even less money these girls could purchase substantial dresswear if they were properly educated in these matters.

At the recent Conference on Housing, Clothes and Health of Girls, an enterprising department store exhibited apparently very beautiful dresses, warm undergarments and outer coats of substantial material and for remarkably reasonable prices. An employee of the store demonstrated the practicability and neatness of these garments.

The fad that makes young girls consider it smart to wear as little clothing as the present lenient interpretation of decency will permit, the extreme shortness of the women's everyday dress, the thin silk stockings and low shoes worn in the coldest weather while the other portion of the body is wrapped up in thick woolen or fur coats, must be considered contributing factors to the deplorable death rate among young women.

FOOT DAMAGE FROM HIGH, NARROW HEELS

Concerning the local damage done by the very low shoes with very high and narrow heels, I am indebted to no less an authority than Professor Reginald H. Sayre for the following interesting personal communication:

"There is no question that the very high narrow heels, which are at present fashionable, are very apt to produce troubles with the feet, and I have had numerous patients come to me complaining that they were constantly twisting their ankles, and asking what could be done to

help this condition. One of them quite frankly said that while she wore sensible shoes her ankles did not twist, but that she did not want to wear shoes with broad heels of a reasonable height, but wanted me to devise a scheme by which she could teeter around on a pair of stilts with heels the size of a ten-cent piece and still preserve her balance."

FIG. 2.—Modern Footgear for Women

The extremely high heel in my opinion is also responsible for an abnormal position, induced by the entire weight of the thorax being thrown forward, away from the median line. The result is a weakening of the abdominal wall followed by the displacement of the vital organs in the abdominal and pelvic cavities, a condition known under the name of enteroptosis.

FATIGUE FROM SCHOOL WORK AND SUSCEPTIBILITY TO TUBERCULOSIS

Our college girls, who dress just as unhygienically and are just as eager for boyish figures as the working girls, perhaps are often the leaders in these fashions. They, too, are often overworked by school lessons. Concerning the overburdened curricula in our schools, I received as recently as November 1, 1927, a communication from the United States Bureau of Education in which is quoted a statement by Professor Worrington of Leipzig, which also appeared in the *Zeitschrift fur Tuberkulose* (April, 1926). He says: "Prolonged school hours lower resistance to infection. Keeping still and keeping well do not go hand in hand, and when home-work is included, the growing pupil has a long confining day." As a result of his investigations, Worrington concludes that four hours should be the maximum for the elementary school and five hours for the upper grades with no home work. An eminent American authority on education, Professor Thomas M. Balliet, Ph.D., LL.D., Dean Emeritus of the School of Pedagogy of New York University, tells me that four or even five hours of continued study or recitation, with not too large classes (35 to 40) in well ventilated class rooms, would not produce fatigue if after each hour of instruction a 5 or 6 minutes' recess would be made the

rule. This recess would not only prevent the pupil from being bored and mentally fatigued, but would make him more alert for the next lesson.

I wonder if a similar practice also among our young workers, employed at continuous monotonous tasks in workshops and factories, would not lessen fatigue, diminish the frequent accidents and keep the workers in better general physical and mental condition.

My personal experience with tuberculous and predisposed children who receive their education in open-air schools, or open-air classes, with frequent recesses, has convinced me that much fewer hours are needed to educate our children when they live and work under the best possible hygienic conditions.

The same holds good of workshops especially constructed and conducted for the men and women with an arrested or slightly active tuberculosis.

Every girl working in factory, office or store, and also our children at school, should have at least one hour for luncheon, and recreation. It is irony indeed to teach pupils the principles of hygiene, including slow eating and chewing the food thoroughly when, as in the New York schools, they are given 50 minutes for luncheon, including going to and coming from home or the luncheon place (which often takes 20 or 30 minutes) and to wash their hands as they are taught to do before eating.

HOW THE YOUNG GIRL MAY PROTECT HERSELF

The girl between 15 and 25 should realize that a little overweight at that age is not as dangerous as ten or fifteen pounds underweight; and that a good appetite at noon or at any time should be satisfied.

It is well-known to all clinicians and particularly to workers in tuberculosis that persons with certain postures and types of build are predisposed to the disease. John Bulwer[4] wrote on this subject as far back as 1650, and in our own time Professor Goldthwait[5] of Boston has very pertinently said that lungs cannot be properly developed unless the posture of the body is correct and that the attainment of a proper posture helps in the cure of tuberculosis.

To counteract the slouchy bent-over position, let the young woman be taught the benefit of walking and sitting upright, and assured that to assume a proper position all the time is not only more healthful but more becoming. These young girls should also bear it in mind that well-developed breasts are an addition to a graceful figure. When

4. U. S. Public Health Service Bulletin: A résumé, with comments, of the available literature relating to posture" (Surgeon Schwartz).
5. Goldthwait, Joel E.: "The Opportunity for the Orthopedist in Preventive Medicine." Jour. Orthopedic Surgery, 1916, Vol. 14, pp. 443-449.

the work of the young women demands sitting, employers should see that properly constructed chairs are provided.

Our American Posture League, 1 Madison Avenue, New York City, which furnishes models for such chairs, has recently issued an excellent chart showing the correct and incorrect postures of a young woman[6]. I take pleasure in reproducing these two pictures, showing how much more natural, graceful and healthful correct posture is, leaving aside the fact already mentioned that proper posture helps to prevent the development of tuberculosis. (Figs. 3 and 4.)

FIG. 3.—Correct posture preventing the development of pulmonary tuberculosis.

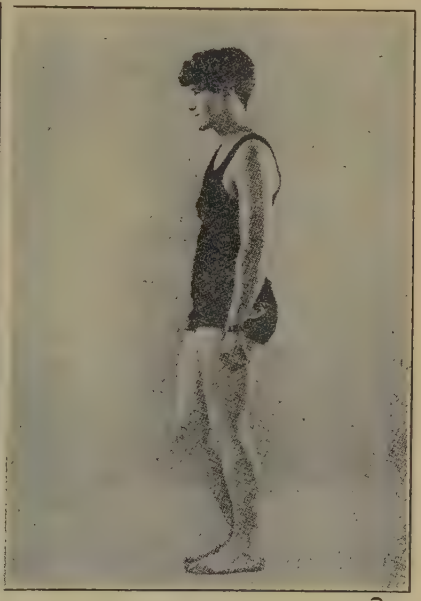

FIG. 4.—Incorrect posture predisposing to development of pulmonary tuberculosis.

We have already referred to the absurdly small and very high heel that makes it virtually impossible to take a vigorous walk in the fresh air, as every indoor worker should take at least once a day. During such a walk in the open air any one can take a breathing exercise without attracting attention by inhaling deeply while raising the shoulders and making a rotary backward movement, holding the breath for a few seconds, and then exhaling while moving the shoulders downward and forward.

The accompanying illustration will show how this can be done—walking, sitting or riding. (Fig. 5.) This exercise should never be taken to the extent of tiring one's self, and should always be taken in the fresh air.

6. Fisher, George J.: "Good Posture a Fine Art;" Amer. Posture League.

FIG. 5.—Breathing Exercise with Rolling of Shoulders

DANGER OF OVERHEATED, DRY ATMOSPHERE

It would be unfair not to state that the increased sickness rate among our young working women is also due to the fact that so many more young women than men work and live in unhygienic environment.

Many a catarrh or more serious trouble of the respiratory system has been contracted in the over-heated, dry atmosphere of office or workroom. No office, factory, workshop, store, or classroom in public or private schools should be without a thermometer. Concerning this Professor C. E. A. Winslow of Yale has been good enough to send me the following communication:

> "I am greatly interested to hear that you are preparing a paper on the problem of tuberculosis among women office workers.
>
> "There are so far as I am aware no very good sources of solid statistical information as to the effect of over-heating upon tuberculosis death rates. On the other hand, we have clear and ample evidence that various acute respiratory infections are greatly increased in incidence by relatively slight degrees of over-heating. In our New York work, we found in comparing a group of school rooms with an average temperature of 68½° with another group of school rooms having an average temperature of 66½° that the former showed 18 per cent more absence due to respira-

tory disease and 70 per cent more respiratory disease among pupils in attendance.

"I believe the problem to be one of the first importance with regard to tuberculosis as well, and I think you cannot emphasize too strongly the importance of the thermometer as an essential article of furniture in every office. When the temperature exceeds 68°, something should be done about it.

"The most practical method of ventilating offices, unless they are very large, is by the use of slanting window boards with radiators under the windows to temper the incoming cold air."

HOW TO MAKE A WINDOW VENTILATOR

There are a number of such devices in the market and I am illustrating one of them. (Fig. 6.) It shows that anyone handy with tools can make such a window ventilator.

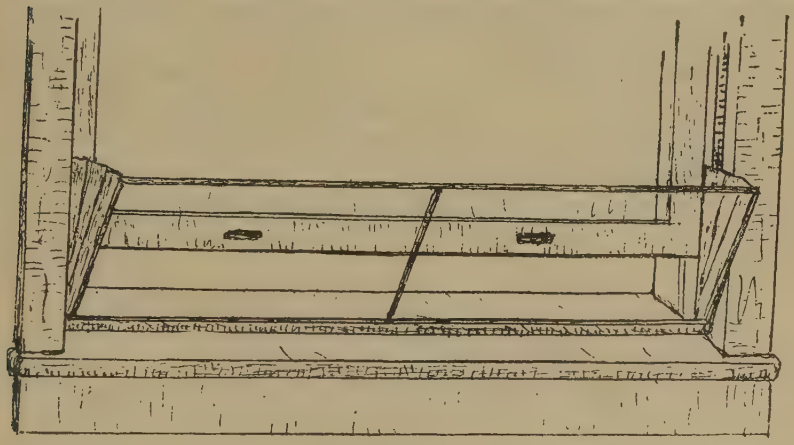

FIG. 6.—Slanting Window Ventilator.

The ventilator consists of two brackets, one at each side of the window frame, that hold a glass or board the width of the window and ten to fifteen inches high. The glass touches the casing at the bottom and slants inward so as to be three or four inches from the window at the top. When the window is open four or five inches at the bottom, the ventilator serves to deflect and to diffuse the air coming in, so that persons seated near the window do not feel the draught; also it permits of having the window open in stormy weather, as the glass will keep water from coming in even if rain is striking against the windowpane.

DUST ELIMINATION IMPORTANT

In any workshop or factory or even in any office where the manufacturing or handling of articles produces a considerable amount of vegetable or mineral dust, modern ideal electric dust collectors should

be installed. In fact, this should be obligatory and legally enforced by the Bureaus of Industrial Hygiene that now exist in various states and are doing such effective work in preventing disease and accidents among our laborers.

BENEFITS OF A DAILY SERIES OF RESPIRATORY EXERCISES

Where there are many girls employed in office, factory or workshop, or congregated in classrooms, a daily recess of about ten to fifteen minutes should be taken to go through a complete series of respiratory exercises. Of course this must be done outside of the workroom or classroom or with all the windows open. The benefit of the deep breathing of good pure air, to girls required to sit still for hours at a time or confined indoors for equally long periods, must be evident when we recall the following facts:

Under ordinary conditions we never inhale or exhale more than about 500 c. c. of air, which represents the tidal volume, or tidal air. When we inhale deeply, we are able to take in 1,500 c. c. of air (complemental volume, or complemental air). About the equal amount of supplemental or reserved air can be expelled by making the expiratory exercise corresponding in effort to the inspiratory exercise.

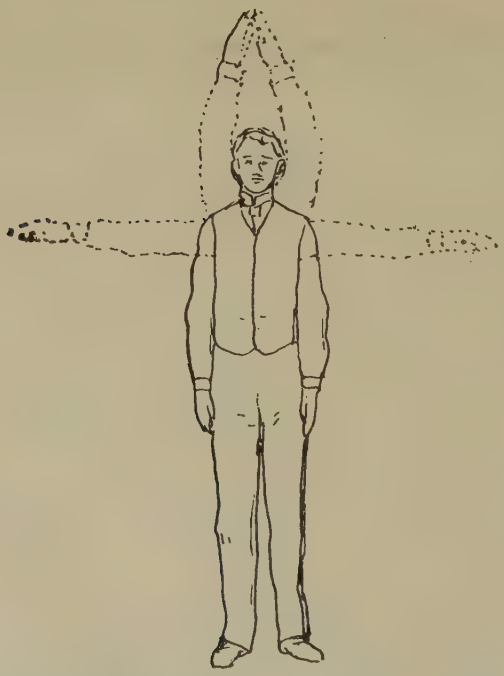

FIG. 7.—Breathing Exercise with Raising Arms to Horizontal and Above the Head

The *modus operandi* of these exercises is simple: Assume an upright position, standing straight, with feet slightly apart, and arms at the sides. With mouth closed take a deep inspiration (that is, breathe in all the air possible, through the nose), and while doing so raise the arms to a horizontal position. Remain thus holding the air inhaled from three to five seconds, and while exhaling (breathing out), bring the arms down to the original position. This act of exhalation, or expiration, should be a little more rapid than the act of inspiration.

When the first exercise is thoroughly mastered, one may begin with

FIG. 8.—Swimming Motion for Breathing Exercises

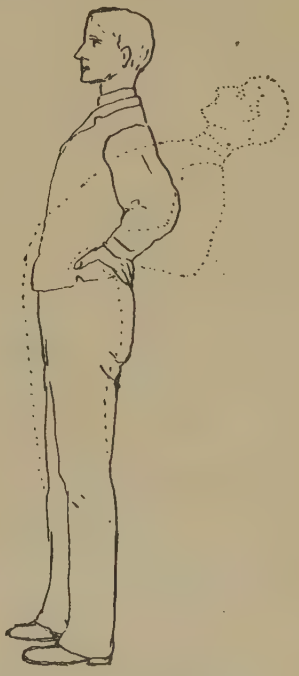

FIG. 9.—Exercise to Combat Stooping Attitude

the second exercise, which is like the first, except that the upward movement of the arms is continued until the hands meet over the head.

The accompanying illustration (Fig. 7) shows the positions that are to be taken during these two exercises. The third breathing or respiratory exercise, which requires more strength and endurance, should not be undertaken until the first two have been practised regularly several times.

I will endeavor to make this third exercise, which might be called a dry swim, more comprehensive by the illustration (Fig. 8).

Assume the same upright position and then stretch the arms out as

in the act of swimming, the backs of the hands touching each other. During the inspiration move the arms outward until they finally meet behind the back. Remain in this position a few seconds, retaining the air, and during the exhalation bring the arms forward again. This somewhat difficult exercise can be facilitated and made more effective by rising on the toes during the act of inhalation, and by descending during the act of expiration.

HOW TO COUNTERACT STOOPING

To counteract the unwholesome habit of stooping, the following exercise is recommended. The individual makes the best effort to stand straight, places the hands on the hips with the thumbs in front, and then bends slowly backward as far as he can during the act of inhaling. Remain in this position for a few seconds, while holding the breath, and then rise again somewhat more rapidly, during the act of exhalation. (Fig. 9.)

The following general rule concerning breathing exercises should always be remembered: Commence with the easier exercises (Fig. 7), and do not begin with the more difficult ones (Figs. 8 and 9) until the former are completely mastered. Take from three to five deep respiratory exercises, either of one kind or the other, whenever in good air and it is convenient to do so, but never when tired, nor to the extent of getting over-tired. Restricting bands, or brassières, will, of course, interfere with taking these exercises properly.

May I say in passing, for the benefit of the pupils in our elementary and high schools, that, besides breathing exercises, singing and reciting in the open air, when the weather is not too cold, are most beneficial; they tend to develop and to strengthen lungs and throat.

GIRLS SCORED ON A "CHARM CHART"

Occasional short talks on proper food, clothing, cleanliness and general and personal hygiene are already in vogue in some of the larger concerns where young women are employed, and are of inestimable benefit and help in the prevention of disease.

In Cleveland, where they are evidently in deep earnest to reduce the mortality of tuberculosis among working girls and college girls, they have instituted in their schools what is known as a "Charm Chart," which is intended to cultivate simplicity, neatness in dress and personal appearance, and good habits. Such items as hair poorly cut, bleached, with dandruff, take marks off the score, while no bloomers, garters showing, too much rouge, heels run over, gum, all definitely prevent a 100 per cent appearance, and mark a loser in school rating and in business success.

AN EFFORT TO OBTAIN BETTER HOUSING FOR GIRLS

The conditions under which many of our small-salaried working girls live—girls who are, occasionally, even without employment—are often deplorable in nearly all of our large cities.

In New York City we have an Association to Promote Proper Housing for Girls, but this very worthy and humanitarian enterprise has been hampered in its activities by the lack of means. It has only been able to provide rooms at the reasonable rate of five dollars per week, and able also to look after the good moral and physical environment of about 500 girls. At a recent meeting of the Association, I learned that there were over five thousand such rooms needed for the number of girls working in this great city who have no family home.

Boston is likewise awake to the need of providing proper housing for its working girls. A society, known as the Boston Students Union, is making a success of a new plan. In the main, the plan is much the same as that which functions in New York, but in esthetic Boston, the ladies interested in the movement not only see to proper supervision of the girls housed by them, but are trying to make the rooms for those girls as attractive and beautiful as possible, as an inducement to stay at home instead of running after questionable amusements. There should not be a city or town of any size, where numbers of young girls work but have no family home, without some committee or organization to look after their welfare.

There is no question but that when the working girl must travel a long distance every day to and from work, often obliged to remain standing for half an hour to one hour in the vitiated air of an overcrowded subway, elevated or street car, that this is an additional fatiguing factor, making her less resistant to colds and more serious diseases. I would therefore suggest that in large cities, where clubs are organized to give the working girls better housing facilities, whenever possible these should be located at not too great a distance from the business centers.

WAYS OF LIVING THAT PREDISPOSE TO TUBERCULOSIS

Unfortunately the unhygienic dress, the intentional undernourishment and the relatively unsanitary office, workshop, or home are not the only causes of the increase of tuberculosis among our young women. Their way of life also has a good deal to do with it.

Descriptive of a picture entitled: "The Pace That Kills," (Fig. 10) representing a young woman dancing with death to the strains of jazz music (in *The Survey* of November 15th, 1927), we read:

"Girls have flocked into business and professional life since the War; but they haven't yet learned how to take care of themselves. It is not at all unusual for a girl to work in an office eight hours a day, then go home, help get supper, make beds, clean the house, wash dishes, and then go out and dance half the night."

Donahey in Cleveland Plain Dealer

FIG. 10.—The Pace That Kills.

Young women have entered many occupations formerly pursued only by men, demanding a considerable amount of physical force and endurance which women rarely possess, even if relatively strong. Some of them are really girls who have started to work when they were not even fully grown and developed. As a result they are neither physically nor mentally fitted for their task and frequently break down.

There is nothing that will aggravate a predisposition to tuberculosis more than excessive fatigue which is not compensated by sufficient rest and sleep. The result of a continual strain on the entire system is all the more dangerous for the adolescent. It is between the ages of 15 and 25, the susceptible age, that one should be particularly careful to lead as healthful and normal a life as possible, without much continued physical and mental wear and tear.

EARLY SYMPTOMS

There are many signs and symptoms which are warning signals of the beginning of tuberculosis. There is the anemic appearance due to blood poverty. Soon there is no need of intentional undernourishment because there is actual loss of appetite and loss of weight. Dry and irritating cough makes its appearance and sometimes there is expectoration with little streaks of blood. While this tiny or perhaps a little more abundant hemorrhage is usually believed to come from the nose or throat, which may be possible, it comes more frequently from the lungs. Sometimes there is an increased nervousness, exhilaration or depression, and last but not least, there is a little fever in the afternoon, some times so little as not to be perceptible except with the use of a thermometer.

When any one of these symptoms arises, let me repeat they are nature's kindly warning signs of a condition which is not yet dangerous but serious enough to need medical aid and proper treatment at the right time and in the right place, so as to prevent the development of a typical pulmonary tuberculosis. Such conditions always call for a careful examination by a competent physician who alone can determine whether or not these symptoms are due to an approaching tuberculosis; this; however, need not alarm anybody, for detected early and treated at once the disease is almost invariably cured and physical strength and earning capacity will return in due time.

Again, the symptoms may be so slight that the examination will reveal merely an extreme fatigue and nervousness, so that a little rest, more sleep and change of habits or occupation may suffice to remedy this condition.

SMOKING PREDISPOSES TO TUBERCULOSIS

Among our young women excessive cigaret smoking[7], the often more than occasional indulgence in bad alcoholic drinks, exciting games and altogether too much night life, result in insufficient sleep, and become contributing factors to tuberculosis or other infectious or nervous diseases.

7. Freudenthal, Wolff: "Tobacco—Its Relation to the Upper Respiratory Tract." The Laryngoscope, March, 1927.

Concerning cigaret smoking, it seems that the young woman, when addicted to the habit, is less able to stop than the man. It is further a well known fact that the outdoor worker and the well nourished individual can stand the nicotine and other poisons resulting from cigaret smoking much better than the indoor worker or lean person. The girl who intentionally undernourishes herself for the sake of a slender figure and also forms the habit of smoking is adding to her predisposition to tuberculosis thereby.

No one would wish to deny some pleasure to the young girl after a hard day's work, but it is the extreme indulgence in pleasurable pursuits that does the harm. While outdoor recreation would be most desirable, many indoor amusements are harmless taken moderately. The excess only is deplorable.

PERIODIC HEALTH EXAMINATIONS MIGHT SAVE THOUSANDS

The young girl living like the five or six thousand working women in the City of New York without family connection must be seriously ill before she will seek medical aid. Even in the majority of families which have a family physician all the members are rarely seen by him. He is rarely consulted about the daughter who is at work until there is real trouble, when rouge and lip-stick can no longer hide the anemic condition, the cough cannot be suppressed, the loss of weight becomes emaciation, and other symptoms make a serious state of health evident to family and friends. If, of course, there were an obligatory periodic health examination and a certificate of health were required by every employer, thousands of women might be saved from invalidism and early death.

Here, however, let me say that my long experience with tuberculosis has taught me that an annual examination of individuals between the ages of 15 and 30, the most susceptible age, when our death rate from that disease is highest, is not sufficient. There must be a careful, semi-annual health examination, if we wish to decrease tuberculosis among these young persons, and particularly among the girls. I have discovered distinct physical signs accompanied by slight but characteristic symptoms, in such young people, indicating an early tuberculous invasion. Yet these persons had been declared in perfect health by skilled examiners 7 or 8 months before.

WOMEN SHOULD COOPERATE TOWARDS MORE HEALTHFUL LIVING

The solution of our problem requires, however, not only the periodic health examination and the physician's counsel on how to live but, also, the cooperation of the mature and sensible woman in every calling who

should, by her manner of dress and bearing, show the fallacy of the dress and manners to which so many young women are now addicted.

Kindly advice by mothers and also by teachers, ministers, directors of Girl Scouts, Camp Fire Girls, officers of girls' clubs, etc., may accomplish much towards a rational dress reform and normal, healthful living, and thus aid the medical profession in its desire to prevent the alarming morbidity and mortality from tuberculosis among our young women.

NEED OF SANATORIA FOR THE ADOLESCENT AND OF INFANTORIA

A somewhat more remote cause of the frequency of tuberculosis among young girls, and also boys, is the utter lack of sanatorium facilities for the adolescent. Children between 12 and 15 obviously cannot be kept in our preventoria where both sexes are treated prior to adolescence, and because of their youth they are not admitted in sanatoria for adults.

Another remote but not less important cause that must be borne in mind, if we really wish to conquer tuberculosis, is the almost total absence of infantoria, that is to say, institutions where children of tuberculous parents, so often predisposed to the disease if not already infected, can be treated from the earliest possible time after their birth until they are cured or their predisposition mastered. We have in Calmette's method of immunization[8] a harmless and seemingly very effective means to help solve the problem concerning tuberculous infants.

The first typical infantorium was made possible for the States of New York and New Jersey by the philanthropic efforts of Dr. Alfred F. Hess at Farmingdale, N. J., but the enterprise had to be abandoned recently for lack of funds. Yet, to my mind, such infantoria should be in operation at least in all large centers of population. A child predisposed to tuberculosis, or having it in a latent form, may live up to adolescence without the slightest symptoms of the disease; but if at that time he or she is subjected or subjects himself or herself to malnutrition, insufficient clothing, hard work, irregular hours and unsanitary environments in general, tuberculosis is almost bound to develop.

Among high school and college girls, the curricula should be arranged so as not to be detrimental to good physical and mental development.

Our well-meaning and well-to-do fellow citizens should aid our municipal authorities in the establishment and maintenance of infantoria for the offspring of tuberculous parentage, preventoria for the

8. Calmette, A.: "Premunition des enfants nouveau nés contre la tuberculose par le vaccine." B.C.G. Ann. de l'Inst. Pasteur, 40: 89, 1926.

adolescent of both sexes, special sanatoria for women between the ages of 15 and 30, such as Stonywold in the State of New York, and should sustain and further all enterprises that will help in the economic, moral, physical and intellectual welfare of our working girls. They must also learn, however, to lead healthy and normal lives.

Lastly, I make a plea to the opposite sex, that is to say, to the young manhood of our nation. I owe the inspiration for this plea to a distinguished woman physician, who is responsible for the health of nearly one thousand girls. She has expressed the belief that if her pupils would read this address, it would be "a word in season and many would be benefited." She says that she has done a good deal of talking on tight brassières, too short skirts, too high heeled shoes, etc., but seemingly to little effect, and added significantly: "We all know that the girls often dress to please and attract the opposite sex. Therefore if our young men could be induced to see that point of view, they might, through formation of clubs and other propaganda to choose the best type of girls, induce them to change their flimsy garb and unwholesome attitude." This seems to be a wise suggestion.

Thus my plea is for and to the young women of America, the future mothers of the nation, and to the young manhood, both responsible for the physical, moral and spiritual strength of the present and future generations. May it not be in vain.

LIGHT AND LIFE

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As a preliminary to the discussion of the subject Light and Life, we should first define the words that appear in this title. In the Century Dictionary, six full columns, the equivalent of two pages of fine print, are devoted to definitions of the word "light." Whether used as an adjective, a verb, or a noun, this word in its various shades of meaning always connotes something cheerful and good. As we shall use the term today, we refer to that meaning of the word that is prevalent in the realm of physics.

The lay use of the word "light" refers to that form of energy which makes things visible. As the physicist uses the word, he includes in its meaning that form of energy that is transmitted through the ether in pulsations of varying rapidity or wave lengths at a certain definite speed of travel. These may cause a sensation in our brain, mediated by the retina of the eye, but also they may include a vastly more extensive band of wave lengths, some much greater in magnitude than those of visible light and some of much shorter wave lengths than visible light. This total gamut of vibrations of varying wave lengths constitutes what is known as the electro magnetic spectrum.

There is no one theory that satisfactorily explains all the observed facts about this form of energy, but there are theories that are useful in explaining some of the things about these emanations.

In order to understand the nature of light it is necessary to know something about its source. All of us realize in a general way, of course, that the primary source of light on this earth is our sun. Perhaps it is not so well known just what takes place in the sun that results in the emission of light waves.

The sun is made up of matter. All matter is made up of molecules, and molecules in turn are made of atoms. It is only of comparatively recent date that we have come to understand that the atom is not the smallest particle of matter but that it in turn has an internal structure. The internal structure of an atom seems to be made up of charges of electricity. At the center of each atom is a comparatively large charge of positive electricity, and surrounding this central nucleus, which is called a proton, are minute specks of negative electricity, which are called electrons. The electrons of a given atom are whirling at some definite rate in orbits around the central proton. The simile of a planetary system seems to be a true one. Just as in our own planetary

system the earth and the other planets are revolving about a central sun, each in its own definite orbit at its own distance from the sun, so in a single atomic planetary system the electrons are revolving each in its own orbit around the central proton.

An analysis of this phenomenon indicates that energy must be present to hold the electrons in their orbits at these definite distances from their central proton. If more energy can be imparted to an atomic system, some of its electrons will be permitted to travel at greater distances from their common proton, still being attracted to it. Likewise, if energy is abstracted from an atomic system, it means that some of the electrons must swing in nearer the proton if they are still to be held by the attraction energy still available.

Moreover, if through some outside influence an electron can be driven in toward its proton, then a certain amount of energy is released from that atomic system to travel elsewhere. Likewise, if there is no longer a possibility that it be held in attraction to that proton, then there is released from the whole system a quantity of energy that had been previously tied up in holding the electron to its proton. While there is no physical connection between a proton and its electron, one can imagine such a connection as exists in the form of a string when the small boy whirls about his head a weight attached to a cord. If the boy lets go of the string, the weight and string and all fly from his grasp and travel in a more or less straight line outward. The boy represents the proton; the weight, the electron; the string, the attracting force.

Likewise, when for any reason an electron is caused to leave its orbit, it carries with it a certain amount of energy and this energy leaves the atomic system.

THE COURSE OF A SINGLE PULSATION OF ENERGY STARTING FROM THE SUN

It is a fact that the atomic disturbances in the sun, which result in the release of the electrons, release little pulsations of energy, which travel off from the sun in a more or less straight line through the ether. Each little increment of energy so released travels on and on at a definite speed. This speed has been determined to be about 187,000 miles per second. If this increment of energy has been released from the sun in the proper direction, it will eventually arrive at our earth. If in some other direction, it will arrive perhaps at the planet Mars. If it arrives at some particular surface of another planet, which happens to be the surface pointed approximately toward our earth, the pulsation may be reflected and then travel to our earth where it may enter

the eye of an observer, or possibly be reflected from some object and in turn be observed by the hypothetical inhabitant of a third planet.

A PROCESSION OF IMPULSES TRAVELS FROM SUN TO EARTH

Thus far we have considered the theoretical course of a single pulsation of energy starting from the sun. As a matter of fact, the atoms in the sun shoot off their electrons and deliver to the surrounding ether increments of energy in rapid and varying succession, like a bunch of firecrackers exploding. It must be supposed that these impulses of energy are discharged in all directions, and so far as we know, in no particular regularity of time. The phenomenon perhaps can be pictured as what we would speak of carelessly as a continuous bombardment of the surrounding ether. The chances are, therefore, that after some period of time a second impulse will start out over the same route as the first one and follow its course faithfully. The second impulse will be traveling exactly at the same rate as the first one and will follow its course in time and direction just as the rear rank of a file of soldiery follows the leader, or as one of a chain of convicts marching in lock step where there is no possibility of one traveling faster than his predecessor nor of his traveling in any other course than that laid down by the leader. After the second impulse there will come at some period of time a third impulse and a fourth and so on, forming a procession of impulses traveling from sun to earth.

THE CONSTITUTION OF A RAY OF LIGHT

It is difficult to understand why it is, although the fact has been observed, that some of these processions consist of impulses spaced equally apart in time and therefore in distance. Such an orderly procession constitutes a ray of light. The impact of the series of impulses in this ray of light received upon the retina of the eye creates a series of nerve messages which, traveling to the brain, are interpreted by the observer according to his experience as light or color. A baby is possessed of the sense of sight, but it does not know the difference between one color and another. Many of the lower animals react differently to rays of light of different colors, but by the wildest stretch of our imagination we can hardly assume that the protozoan can recognize red light as red, or blue light as blue. It does recognize by some process of bio-chemistry a difference in the let us call it feeling, which is induced by a procession of light impulses spaced at one interval, as being different from the sensation produced when the series of light impulses arriving is spaced at another interval. The terms red, yellow, blue, etc., are purely artificial terms, and are convenient handles that we have attached to describe certain particular kinds of sensations.

THE LIMITATIONS OF THE HUMAN EYE

The human eye is possessed of a mechanism that enables it to receive and to transmit to the brain a limited number of these wave trains or processions of light impulses. We say that the human eye is adapted to interpret wave lengths of light. There exists, however, a vast number of wave lengths of light that differ in no respect from visible light except in their wave lengths, which, however, our eye is not adapted to receive and which cause no sensation.

The term wave length refers to the distance between successive impulses in a train of electro magnetic vibrations. The distance between these successive increments of energy in visible light is exceedingly small. In order to express this unit of distance we have to use an uncommon unit of length. Two such scientific units of length are used in describing the wave lengths of light. One of them being ten times the value of the other. These two units are respectively the micromicron and the Angström unit. In all scientific work the metric system of measurement is employed. The units used to describe the wave lengths of light are accordingly to be found in the metric system.

One inch is equivalent to approximately twenty-five millimeters; one millimeter is one thousand microns; one micron is one thousand micromicrons; one micromicron equals ten Angström units. To express this unit of distance as a simple fraction of an inch makes an exceedingly cumbersome and unintelligible quantity. It is possible, however, to suggest by analogy to some extent the order of minuteness of this unit of measurement. The lead in an Eversharp pencil is about one millimeter in diameter. If you can imagine one one-thousandth part of this distance, that equals one micron. It is a unit of distance which can not be distinguished by the naked eye, but which can be measured by a microscope. In turn let your imagination divide that distance by a thousand and you have a micromicron, a unit of distance that cannot be seen even with the highest powered misroscope, but which can, however, be measured by a delicate physical instrument. This distance in turn divided by ten equals one Angström unit.

All of the light wave trains that have a wave length between 700 micromicrons and 600 micromicrons can be received by our eye and are interpreted by us as transmitting either red or orange light. Likewise, those wave trains whose length is between 600 and 500 micromicrons, when received by the eye are interpreted in the brain as being the evidence of yellow or green light. The shortest wave length that constitutes visible light is in the neighborhood of 400 micromicrons and gives the sensation of violet. Wave lengths of greater extent than the largest figure and of shorter distance than the smallest figure men-

tioned constitute what we speak of as invisible light. Light waves of the magnitude of one hundred million times the wave length of visible light are used for the transmission of radio. Light waves one hundred thousand times smaller than the wave lengths of visible light constitute X-rays. At the upper end of the scale, just beyond red light, there occur bands of light waves that we designate as heat waves, or infra-red, and joining the lower end of the visible spectrum is a band of smaller wave length light rays that we designate as ultra-violet.

This physical discussion must serve to define the word "light."

HEALTH AND "ENERGY" INSEPARABLE

A healthy person is a vigorous person. A vigorous person is full of energy. Where does such a person secure his energy? We know that energy in this universe is neither created nor lost, but that it may be converted from one form to another. The healthy person is constantly transforming energy from one form to another. All the processes of living require energy transformation. Every time the heart beats, every time our muscles contract in movement of the body, or even in movement of the ribs for the purpose of breathing, energy is transformed from one kind to another. All the chemical transformations of the body are energy conversions.

A living being is a bundle of energy. We often so designate a healthy individual, realizing subconsciously that health and energy are inseparable.

THE SOURCE OF ENERGY

There is only one source for the energy of living things on this earth. It is the sun. Energy comes to us from the sun in the form of light waves, and in no other fashion. This energy from the sun is first entrapped for our ultimate use by the green leaves of plants in which, through chemical transformations, the radiant energy of the sun is captured in that substance called starch. Starch is therefore bottled sunlight. It is the basic food for all plants and animals. It may be transformed into sugar, or if combined with nitrogen, turned into protein, or it may be split and the fragments recombined as fat.

Proteins, fats and carbohydrates, the basic foodstuffs, are valuable only because they contain bottled energy that can be released by the chemical processes of digestion for the use of living things. These foodstuffs are the vehicle for transferring from the sun to living plants and animals the energy required for the maintenance of health.

THE RELATION OF SUNLIGHT TO VITAMINS

It was believed not so many years ago that the proteins, fats and carbohydrates were the only sources of energy necessary to maintain life and health. Within the last two decades there has been developed the

knowledge that for the utilization of the foodstuffs there is required an additional form of energy. Funk believed that this new accessory food substance was of the chemical nature of an amine. He saw that it was necessary for life, and therefore, what more natural than that in casting about for a name for this new substance he should call it the "vita amine" and that later the two words should be contracted to the word "vitamine". When later it was shown that the substance was not an amine, the word had been so widely adopted that its change was found difficult. And so to satisfy the requirements of the exacting chemist, the final "e" was dropped from the original spelling, leaving the now official term "vitamin."

Vitamins have a relation, either direct or indirect, to sunlight, and it must be reasonable to suppose that the energy of the vitamin comes from sunlight.

As will be pointed out later, we are now able to trace a direct relation between exposure to a certain portion of the sun's rays and the development of a particular vitaminic property in certain chemical substances. Such a direct relation in the case of the other vitamins has not been shown. In fact, it is probably safe to say that at the present time direct exposure to sunlight results in the production of only one of the vitamins that are as yet identified.

Considered from a broad standpoint, therefore, light is indispensable to life since light is the source of all energy that is utilized by the body in its normal complete function of living. More particularly, light may contribute to health through the agency of certain photo-chemical changes that are possible in the body of an animal subjected to the impact of certain light rays. Whether or not all of these photo-chemical changes that take place in the body as the result of irradiation with sunlight, or with light of proper wave lengths from other sources, are due to the intervention of vitaminic substances, we cannot at this time say. In fact, no one knows exactly what is a vitamin. We know only that there are present in certain kinds of foods certain properties that make possible the utilization of the calorie and mineral elements of a diet. We know also that if these so-called vitamins are absent, even though a diet be adequate in proteins, carbohydrates, fats and minerals, an animal cannot maintain health.

THE SOURCE OF VITAMIN A

The growth and development of a young animal has been said to be determined by two factors, one of which has been termed the growth impulse and the other the external factor. Of the many items that contribute to make the external factor, undoubtedly the most important is the food supply. Included in the food supply are the well-known

calorie constituents, mineral matter, and water, and in addition, the indispensable vitamins. Vitamin A occurs in the food of the cow before it can appear in the cream of her milk from which butter is made. Vitamin A is not planted in butter nor created in butter; it is passed on to the butter by the cow, if, and only if, her diet has contained this vitamin principle. The source of vitamin A in any animal fat is in the diet of the animal.

Cows fed upon dried grasses and winter feed in general give milk that has a less potency in vitamin A than does the milk that comes from cows fed upon green pasturage. This suggests that vitamin A is formed in green leaves and has led to research for this vitaminic principle in the leafy vegetables as well as in various other sources of food supply. Vitamin A seems to be associated with rapidly growing young green plants in general, and as young green plants ordinarily require sunlight for their growth, there is very likely some relation between light and the production of vitamin A in green leaves. It is not so simple a performance, however, as to be merely the result of sunlight or other light of proper wave lengths shining upon these leaves. It is formed incident to the light chemistry of the plant in some way as yet not known.

HOW VITAMIN A GETS INTO COD LIVER

Another source of vitamin A that takes properly a prominent place in the attention of dieticians is cod liver oil and the oils obtained from certain other fishes. The liver of the codfish is certainly not ever subjected to sunlight during the life of the fish. Perhaps it is not obvious how the vitamin gets into the liver of the cod, but a little reasoning supported by certain experimental evidence shows that this is the way that it happens: Just as the fundamental food substance for land animals is in green-leaved plants, so also the fundamental food supply of aquatic animals consists of green vegetable matter. Floating in the waters of our ponds and in the oceans are hosts of minute plants too small individually to be seen with the naked eye, but readily visible to the miscroscope, occurring in regular geometrical shapes and patterns, containing colored substances, some brown, some green, some red or purple. These minute wandering plants, which collectively are called plankton, meaning the wanderers, must have light for their early development. Spending their infancy at the surface, in old age they subside to the depths if storms and currents do not carry them there sooner. By means of their colored pigments they are able to do what the green plants of the land do, namely, synthesize starch.

The plankton forms the food for the smallest fishes and other marine animals. These minute animalcules in turn become food for larger

forms. The cannibalistic codfish eats other fish, crabs, small forms of life, and perhaps some plankton direct. Directly or indirectly, its diet contains the elements of plant food of the plankton and their substance enters into the substance of the codfish. The vitamin that has been developed in the growing plant becomes transferred to the fatty tissues of the cod and is especially concentrated in its liver. The plankton where the vitamin first became active required light in some measure for its origin, and thus light contributes to the store of the vitamin in the oil of the liver of the codfish in the depths where light is not.

RELATION OF VITAMIN A TO GROWTH

Vitamin A is necessary in the diet of any young animal if that animal is to grow. Without it an animal may maintain a given weight for sometime, but ultimately it will sicken and die. It will not gain in weight after its store of vitamin A has been depleted unless a further addition of this substance be included in its diet. Placing the animal in the sun will not compensate for a deficiency in vitamin A. Animals apparently cannot prepare vitamin A, no matter how much they are exposed to light nor to what kind of light they are exposed.

THE RELATION OF LIGHT TO VITAMIN B

Vitamin B, as we now call it, was the first vitaminic substance to be discovered. Without vitamin B in the diet, young animals not only fail to grow, but usually rapidly lose weight. Without vitamin B in the diet the appetite fails. Certain deficiency diseases arise. Vitamin B is equally essential to health and equally essential to the growing animal with vitamin A. This second vitamin of the list was first found to be associated with the outer covering of rice. It has since been found to be present in the outer coat of other cereal grains. The second vitamin in our list is associated not with fat but with watery constituents of the plant. That is why the term fat soluble has been applied to vitamin A and water soluble to vitamin B, meaning that A is soluble in fat and that B is soluble in water.

McCollum and Davis in 1915 showed that water soluble B is present in milk, although it is not associated with milk fat. Another source of vitamin B, one that has received much publicity, is yeast. Yeast undoubtedly is a very rich source of vitamin B. Apparently in the development and reproduction of the yeast plant upon suitable media, vitamin B is a product of its metabolism and is retained within the yeast cell.

The relation of light to vitamin B is obscure. Vitamin B is formed only in living plants, and to the extent that living plants require light for their proper development, vitamin B is related to light. On the

other hand one may grow a culture of yeast in a dark incubator in the laboratory and the yeast cells of this culture will apparently be supplied with vitamin B. Where do they get it? I do not know. Possibly from the nutrient medium upon which the yeast relies for its food. Obviously the relation between light and this vitamin is not clear at present.

THE RELATION OF LIGHT TO VITAMIN C

The third vitamin, which we call C for convenience, is the vitamin found particularly in the juices of citrous fruits. It is not preeminently necessary for growth and maintenance of weight in young animals, but oftentimes experimental animals, which have a diet adequate in the other vitamins, do not thrive so well unless there is supplied to them tomato juice or the juice of some fruit containing the vitamin C. This vitamin is of course that which prevents the onset of the deficiency disease known as scurvy, and attention to this vitamin has been directed to its effect in preventing this particular disease. Vitamin C very likely aids in the maintenance of health in other ways. Just as we know that a child that has the disease rickets cannot obtain normal development of its bony structure and therefore cannot obtain normal growth, so also a child that has any degree of the deficiency malady that we call scurvy must be inhibited from obtaining its full and complete growth. Vitamin C is clearly necessary for health. Being found as it is in fruit juices, and since fruits grow upon plants in the open air subject to the rays of the sun, it appears that some relation between light and the production of vitamin C may be postulated.

Exposing an animal to sunlight, or to rays of light of proper wave lengths from any other source, will not supply or remedy a lack of vitamins A, B or C. These vitamins must be secured in the diet.

CERTAIN ULTRA-VIOLET WAVE LENGTHS EFFICIENT IN PRODUCING VITAMIN D

We come now to the fourth vitamin in the list, vitamin D. This substance is associated with fat. For many years it was not recognized that vitamin D was different from vitamin A, the two being found oftentimes together but not always so. Vitamin D is the fat soluble vitamin that prevents the onset of rickets, a deficiency disease in which calcium cannot be utilized by the tissues, resulting in spongy structure of bones and in the very young animal the failure of the ends of the bone to calcify properly. Two things are primarily necessary in the prevention of rickets. Both must be taken care of in the diet. In the first place, the mineral requirement must be met, especially in regard to calcium and phosphorous. A diet very rich in minerals will not pre-

vent rickets, however, unless at the same time the diet contains an adequate amount of vitamin D. Likewise, a diet that is plentifully supplied with vitamin D will not prevent rickets unless the diet contains an adequate amount of calcium. It is as if the vitamin D acted as a vehicle or carrier for the calcium particles, transporting them into the tissues and unloading them in the bony structure where they are required in the formation of good hard bones and teeth. It is also a possibility, although not clearly proved with certainty, that an excess of vitamin D in the diet, in the absence of sufficient calcium and phosphorous, is more harmful than is the mineral deficiency alone. This I regard as a suggestion of the later work that has partly been proved and corroborated.

Vitamin D is of especial interest to the student of the effect of light on health because it has been shown beyond any doubt that vitamin D can be built up in the animal's body as the result of exposing that animal body to light of certain wave lengths. The wave lengths of light that bring about this photo-chemical effect are situated in the band of ultra-violet. Within this band of ultra-violet are certain waves of comparatively long length and other waves much shorter. The longer wave length portion of the ultra-violet has been termed by some the vital rays. These are the wave lengths that are particularly efficient in producing vitamin D. They are present in sunlight.

This ultra-violet light acts upon a constituent of the hair and skin that is associated with cholesterol. The vitamin D formed by the irradiation of cholesterol presumably is transported by the body fluids to the necessary place for its action in the body. That is the reason why ultra-violet light has been used successfully in curing a condition of rickets in children. It would not have brought about a cure, however, had not the calcium and phosphorous of the diet received adequate attention.

VITAMIN D IN COD LIVER OIL

Cod liver oil contains vitamin D. It is, in its raw state, generally a rich source of vitamin D. Those cod liver oils that have been subjected to vigorous chemical refinement, in the effort to eliminate taste and to make a highly attractive appearance, may have had some of their vitamin content destroyed. All cod liver oil on the market is not equally potent. The use of a potent cod liver oil will be unsuccessful in combating rickets unless, at the same time, the diet of the child is watched to be sure that there is a sufficient supply of calcium and phosphorous. It is of no benefit apparently to have an excess supply of vitamin D as a carrier for calcium if there is no calcium to be carried.

VITAMIN D CONFERRED ON CERTAIN FOODSTUFFS BY SUITABLE IRRADIATION

Certain foodstuffs that are lacking in vitamin D may have this vitaminic property conferred upon them as a result of suitable irradiation with ultra-violet light. The foods that respond to ultra-violet irradiation in this fashion are generally those that contain a substance associated with cholesterol. Cholesterol is associated with animal fat as well as with other animal tissues. A substance quite similar to it is present in most plant tissues. Apparently, however, other substances, such as purified carbohydrates, free from cholesterol, gain nothing in vitaminic potency if subjected to ultra-violet light.

ULTRA-VIOLET RAYS INCREASE RESISTANCE TO DISEASE

That rickets is recognized ordinarily only when the symptoms are reasonably severe was pointed out by Tisdale at Atlantic City in 1925. Rickets, as such, does not occur in adults, but a softening of the bones may occur. It is believed by some that the great mortality of rickets is due not to bone changes but to marked lowering of resistance to infection. Rachitic children are reported to die of bronchial pneumonia and other similar conditions and this constitutes a factor in infant mortality during winter and spring.

It is highly probable that ultra-violet increases the resistance of adults and children also. In fact, the beneficial effects from ultra-violet were recorded in the case of ailing children before anything was known of the relation of light to rickets. Irradiation of the skin with sunlight or other ultra-violet light causes an increase of blood platelets and possibly of erythrocytes. The serum of an irradiated individual has been reported to show marked increase in its germicidal properties.

VITAMIN E INFLUENCES REPRODUCTIVE FUNCTION

Vitamin E, recently identified as being associated with the germ of wheat, corn and other grains, also in some leaves, also in the tissues of animals fed upon such foods, also in certain vegetable oils, has its effect upon the reproductive process. Without this vitamin, white rats fed upon an otherwise adequate diet will grow to old age and great size without being able to breed. The addition of vitamin E to their diet restores this lost function. It is only three years or so that we have definite evidence upon this point, although many things pointed to this discovery in earlier work.

SUNLIGHT BENEFICIAL IN CERTAIN TYPES OF TUBERCULOSIS

The beneficial effect of sunlight upon patients suffering from certain types of tuberculosis has been amply demonstrated, in elaboration of the work of Rollier in Switzerland in 1903. How sunlight aids in the cure of patients from this malady I do not know.

THE USE OF ARTIFICIAL SOURCES OF ULTRA-VIOLET MUST BE CAREFULLY CONTROLLED

A discussion of light and health would be incomplete without some reference to artificial light. The carbon arc and the mercury vapor arc in a quartz tube emit plentiful supplies of ultra-violet light. This comprises not only the curative rays of sunlight, but also the shorter burning rays of midsummer sunlight, so that the use of artificial sources of ultra-violet must be carefully controlled to avoid painful, even though artificial, sunburn. It is probably true that the longer visible rays of sunlight and the heat rays are of additional benefit, thus making sunlight a little better than artificial ultra-violet. Until recently, exposure to sunlight meant exposure to fresh air, while the use of the lamp was usually indoors. These factors complicate the attempt to draw any comparison.

THE SUN A SOURCE OF LIFE-GIVING ENERGY

That not completely understood is in some degree mysterious. Mystery and magic are dispelled by knowledge. Ancient peoples recognized the cheering and healing effects of sunlight. Hippocrates and Galen recommended sunlight for the cure of disease. In 1928 we appreciate more thoroughly than could the peoples of ancient times the value of light, because we begin to perceive a certain logical sequence of cause and effect in this transfer of life-giving energy from the sun to ourselves.

The Greek temples were in some cases solaria. Today we have open air schools and sun rooms glazed with a special glass that permits the passage of ultra-violet light. And if the day be cloudy, we press a button and at once have at our command an electrical source of these vital rays stronger than that of the noon day sun in an unclouded summer sky. What the future development in the scientific application of light to life, health and happiness may be, we cannot at this time imagine. Will it be an aid to the development of a happier and a better behaved race?

THE HEALTH-PROMOTING RAYS OF SUNLIGHT

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Recent years have witnessed an increasing appreciation and understanding of the value of the cheapest and most familiar form of energy, sunlight. Prior to the present era, man's knowledge of sunlight was limited primarily to the experience of light with which to see, or of light for heat and warmth, or the production of a sunburn with a subsequent tanning if he exposed himself. Even today, the average man understands and knows more about the mechanism and operation of his radio than he does about the properties of sunlight.

A realization that sunlight might have valuable properties other than those mentioned above began at about 1890, when Dr. Theobold Adrian Palm, Aylesford, England, demonstrated by a geographical method that lack of sunlight is an important factor in the causation of rickets. His paper, while it pointed the way, fell on deaf ears. Three years later Niels Finsen began to cure lupus, a form of cutaneous tuberculosis, by local applications of sunlight. In 1900 the London Hospital began the cure of lupus by the same method, and in 1903 Dr. Rollier opened his sanitarium at Leysin in the Alps Vaudioses, the first clinic for the treatment of surgical tuberculosis by sunlight. The investigations of these experimenters have stimulated others, until today it is generally recognized by the medical profession that sunlight plays an important rôle in promoting health.

Investigation of the health-giving properties of sunlight is greatly complicated by the complexity of sunlight itself. Progress is therefore slow. With the combined efforts of the physician, biologist, chemist and physicist, however, much progress is being made, and it appears to be only a matter of time when the influence of sunlight on mankind and on the animal world will be fully understood.

THERE ARE THREE GROUPS OF LIGHT RADIATIONS

The light from the sun as well as from all artificial sources is not a homogeneous form of energy. It is customary for convenience to divide the light radiations from the sun into three groups: Infra-red, visible and ultra-violet. The infra-red radiations constitute the principal source of heat from the sun, and comprise in the average about 80 per cent of the sunlight. The visible light comprises about 13 per cent of the total sunlight energy. The ultra-violet are the invisible light rays that can exert remarkable chemical and biological action. They

represent at the best only about 7 per cent of the sunlight energy. Each one of these three divisions may in turn be subdivided into a number of components, each of which will have different properties. Thus, the visible white light from the sun, when refracted by rain drops to form the familiar rainbow, is broken up into a number of components that appear to the eye as violet, blue, green, yellow, orange and red light.

Light radiations, regardless of their kind, travel through space with the same identical speed. They do not, however, exert similar influence on the substances with which they come in contact. This difference in the behavior of light is familiar to all. Infra-red rays incident upon the skin produce the sensation of warmth; visible light, under the same condition, gives absolutely no detectable effect; and certain of the ultra-violet rays produce a sunburn. There exists, therefore, a great difference in the behavior of the skin to these various kinds of light.

The difference between light rays lies in their form. Everyone who has witnessed the ocean swell (long ocean wave) has seen, in slow motion, a rough example of how light travels through space. Light waves themselves travel with such enormously great speed, 186,000 miles per second, that they cannot be directly observed. Their nature must be determined by a study of their effects.

It is customary to define a light wave by its wave length or frequency of occurrence. The wave length is the distance from the crest of one wave to that of the next succeeding wave of the same kind. The frequency is the number of times a wave occurs during an interval of time. It is evident that since the waves all move at the same speed, a light wave with long wave length will occur less frequently than one with short. This means that the shorter the wave length, the higher the frequency.

Since it is possible to imagine waves of every conceivable wave length, one might expect that the different kinds of light rays might be innumerable. Such is indeed the case. The known light waves extend from the exceedingly small values for the X-ray to miles of length for the wireless. Wave lengths of our visible and ultra-violet portions of the sunlight are so small that it is necessary to express them in special units, known as Angström Units and named after their originator. One Angström unit equals one ten-millionth of a millimeter, or thirty-one ten-billionths of an inch.

WAVE LENGTHS MEASURABLE BY THEIR EFFECTS

The physicist, by using elaborate apparatus, can actually measure the wave lengths of light by a study of their effects. If a beam of light is found to consist of wave length 5790 A. U., it is possible to say

immediately, without having seen the light, that the light will be yellow. Light of that wave length always affects the normal eye in such a way that the sensation of yellow is produced. Likewise, light of wave length 4360 produces the sensation of blue-violet. The wave length definitely characterizes the kind of light. Given any wave length, one can immediately say the kind of light it represents.

INFRA-RED RAYS PRODUCE HEAT IN DEEP-LYING TISSUES

It is inadvisable to discuss in detail all three divisions of the sunlight in one paper, as the complexity of the situation leads to confusion. Of these three portions of the spectrum, infra-red, visible and ultra-violet, the latter, ultra-violet, is probably the least known. The therapeutic application of heat is so familiar to everyone that there is no difficulty in comprehending the value of the sun's infra-red. It appears to be realized by only a few, however, that the heating effect produced by infra-red may be quite different from that produced by an external application of heat, such as by a heating pad or a hot water bottle. The latter method of heat application depends on conductance from a heating source. The temperature at which this source may be applied is limited to the endurance of the skin. Likewise, the skin interferes with the conduction of this heat energy by virtue of its high insulating properties. Hence, an application of heat by this method is purely local, and it is not possible to produce much effect in the deep-lying tissue. On the other hand, infra-red rays are not heat, but light. They are converted into heat only when they are absorbed by the tissue. Certain of them can penetrate through considerable thicknesses of tissue before being absorbed. Consequently, it is possible, by means of infra-red, to produce heat in deeply-lying tissues, and to stimulate biological changes that would be unaffected by an external application of heat.

Visible light is at present an unknown factor in animal therapeutics. It is essential for the plant kingdom. Without visible light, the wonderful process of carbon-dioxide assimilation could not proceed.

VARIATIONS IN THE QUALITY OF THE ULTRA-VIOLET

The third division of sunlight, the ultra-violet, because of an inability to see or feel it, is to the average person an unreality. These rays appear to control and influence to a considerable extent a number of important physiological functions and are, therefore, of great value.

The ultra-violet of sunlight, under the most optimum conditions, comprises wave lengths extending from the visible violet at about 4000 A. U. to about 2000 A. U. Ultra-violet of very much shorter wave length is undoubtedly produced by the sun, but does not reach the

earth because of its inability to penetrate the atmosphere. The wave length of the lower limit of the ultra-violet that reaches the earth is exceedingly variable, being dependent on climatic conditions, geographical location, season of the year and time of day. In a typical manufacturing city, such as Newark, N. J., the shortest detectable wave length is about 2950 A. U. Its presence is indicated only about noon during the summer months. The intensity is exceedingly low, a long photographic exposure being required to record it. During the winter months, the shortest detectable wave length is about 3070 A. U., and this again is present only in infinitesimal quantity and only at noon. These short wave limits of sunlight are probably characteristic of most of the manufacturing cities of the north central and northeastern United States. There is also a very considerable variation in the quality of the ultra-violet of sunlight with time of day. The shorter radiations are available only from about 10 to 2, during both summer and winter.

VARIATIONS IN QUANTITY

Not only does the quality of the sunlight vary greatly with season and time of day, but also the quantity. Measurements made by Dorno at Davos in the Swiss Alps have shown that there is 18 times more ultra-violet from the sunlight on a clear day in July than at the same time on a corresponding day in January. He found that the infra-red intensity of sunlight remained very much more constant than that of the ultra-violet. Measurements made in Newark, N. J., during 1927 indicated that there is about twice as much total ultra-violet from sun in June than on a corresponding day in December. The quantity varies greatly with time of day, the peak being slightly before noon.

The preceding indicates that there is great variation in the quality and quantity of ultra-violet in sunlight. The seasonal variation is evident to all who have compared the sunburning power of the sun of summer with that of winter. When it is considered that cloudy and rainy days deplete the amount of ultra-violet received from the sun, it becomes very evident that the sun's ultra-violet is a very variable factor.

THE THERAPEUTIC ACTION OF ULTRA-VIOLET DEPENDS ON ITS DEPTH OF PENETRATION

Light, and especially ultra-violet light, is known to exert influence on hundreds of chemical reactions. Since reactions of living organisms are largely of a chemical nature, it is permissible to assume that the action of light in health is primarily of a photo-chemical nature. With this assumption it would follow that the known laws of photo-chemistry would hold for ultra-violet therapy. The most important of these laws,

first enunciated by Grotthaus in 1819, states that the light energy must be absorbed by the reacting substance in order to promote a chemical or biological reaction. It is important, therefore, in therapeutic application of ultra-violet light, that the rays penetrate sufficiently far into the tissue to reach the proper reacting substance. The ultra-violet to be of value must either effect changes in substances in the epidermis, which altered substances are absorbed by the body, or must penetrate the epidermis acting upon the substance in the underlying tissue, e. g., the blood and the capillaries.

If the action of light depends on transmission through the epidermis, the ultra-violet must penetrate in an adult at least 1 mm. Medical literature contains many statements to the effect that the very short ultra-violet of sunlight will not penetrate more than 1/10 mm. of skin. This subject has recently been investigated by Macht, Bell and Anderson, who have found that the claims in the literature appear to be correct for dead skin but that living skin transmits considerably more of the shorter wave lengths. These measurements were made on living anesthetized dogs, cats and rabbits, and on human skin fresh from the operating table. Qualitative measurements showed that layers of skin and tissue 3 to 4 mm. in thickness transmitted traces of radiation of shorter wave length than those found in our sunlight. Quantitative measurements made on the abdominal skin of rabbits showed that a large percentage of the short ultra-violet can pass through a layer 1 mm. thick.

The most surprising result of these experiments with the rabbit was that short radiations found only in artificial sources, such as quartz mercury vapor lamps, and not present in sunlight, penetrated through 1 mm. of tissue to a much greater extent than the ultra-violet of sunlight. The rabbit experiment required an elaborate and costly optical system and five experimenters. A number of checks were made on the measurements to insure accuracy. Unfortunately it was not possible to make quantitative measurements through human flesh. Qualitatively, employing photography and the quartz prism spectrograph, it was possible to show that fresh human flesh, the surfaces of which were clean, but from which the blood had not been withdrawn, transmitted the short ultra-violet of sunlight slightly through a thickness of 4 mm. The shortest wave length of sunlight could be detected after 30 seconds of exposure on a photographic plate. The same flesh, however, after having been placed on ice, very rapidly lost its ability to transmit the radiation, and acquired the properties familiarly referred to in the literature.

These experiments would indicate that living tissue and skin are sufficiently transparent to the short ultra-violet rays of sunlight to

enable the promotion of biological reactions in the tissue underlying the epidermis. It was found that blood, even in a thin layer, absorbed the ultra-violet rays completely. Hence, the application of pressure to dehematized tissue increases its transparency to the ultra-violet.

ARTIFICIAL LIGHT SOURCES USED FOR EXPERIMENTS

Careful scientific investigation of the health-promoting properties of the different portions of sunlight demands that a means be available for isolating definite portions of the spectrum. This is an exceedingly difficult accomplishment. Its fulfillment is at present limited to the laboratory, and very costly equipment is required in order to obtain a workable intensity of light. A constant dependable light source is required for experimental work. Consequently, it is usually not possible to employ sunlight, artificial sources being employed. Light energy emitted by these artificial sources, while it comprises the three regions of sunlight, infra-red, visible and ultra-violet, is distributed in a different manner than that of sunlight. All artificial sources give longer infra-red rays than are found in the solar radiation. Many of them, such as the quartz mercury arc, produce shorter ultra-violet than found in sunlight. It will be shown subsequently how the specificity of wave length makes these artificial sources valuable as a substitute for sunlight when the latter is not available.

THE THERAPEUTIC POTENCY OF ULTRA-VIOLET RAYS IN RICKETS

Rickets, a nutrition deficiency condition of childhood, is prevalent in northern latitudes, especially during the winter months. It is accountable for many of the bone malformations observed in later years. Rickets is caused by a deficiency in some substance or substances that promote bone calcification, which for want of a better name have been termed "vitamin D."

It has been observed for a number of years that certain of the ultra-violet rays can alleviate the condition of rickets and promote normal bone growth. Furthermore, it has been shown within recent years by Hess of Columbia and Steenbock at Wisconsin that it is not necessary to irradiate the patients themselves with ultra-violet, but that irradiation of foodstuffs, skin or cholesterol, and subsequent feeding of these to the subjects, will produce the desired result. The substances mentioned above, or ultra-violet rays themselves directly, have the property of establishing a normal calcium and inorganic phosphorus content of the blood. These chemical effects bring about the great therapeutic potency in rickets, since the calcium and phosphorus in the blood are responsible for the integrity of bone formation.

ULTRA-VIOLET RADIATIONS AN AID IN HEMORRHAGE

Normal calcium and organic phosphorus are not only of great importance in bone formation, but also appear to regulate to a considerable degree the amount of iron in the body. More than 70 per cent of this iron content is in the blood. Apparently with a good supply of calcium, and a diet good in other respects, the iron may be used over and over again with very little loss. Blood calcium also appears to play an important rôle in hemorrhage. Hemorrhage is an effect associated with slow coagulation of the blood, and retarded coagulation is in many instances associated with a deficiency of blood calcium. Since ultra-violet radiations can correct this deficiency very rapidly, it is not surprising that such treatment can serve as an aid to the control of hemorrhage. It can be seen from the above that the influence of ultra-violet light in the promotion of normal calcium and phosphorus in the blood is of great importance in maintaining the calcium and phosphorus balance essential to the young for proper bone formation; and in both young and old it controls to a considerable extent the behavior of the blood.

STUDIES OF LONG AND SHORT WAVE LIMITS

The influence of ultra-violet light on rickets, and on the antirachitic activation of foodstuffs, has been subjected to many years of investigation by Dr. Alfred F. Hess of New York, who, as early as 1923, employing selective glass filters, demonstrated that in all probability the long wave limit of the effective ultra-violet in the prevention and cure of rickets was at about 3130 A. U., i. e., just about at the limit of transmission of ordinary window glass.

Recently Hess and Anderson have made new determinations of the effective wave lengths of ultra-violet in rickets and in the antirachitic activation. In these experiments not only was the action of the long wave ultra-violet studied, but also, in view of the large number of artificial ultra-violet sources in use, a determination was made of the value of radiations that are of still shorter wave length than those found in sunlight. The same optical apparatus was employed for these experiments as for the previously described experiments on transmission. The light was spectralized by means of quartz lenses and prisms in such a way that single wave lengths or groups of wave lengths could be selected, and the quantity of light received was measured by means of a thermal electric device known as a thermopile. In the course of these experiments, the ultra-violet was divided into two definite regions, one extended from 2500 to 2800, not at all present in sunlight; and a second included the ultra-violet of sunlight from 2900 to 3400 A. U.

Two groups of rats were maintained on a ricket-producing diet until X-ray showed that they had developed rickets. These animals were then continued on the diet and at the same time irradiated with one or the other of the two regions of the ultra-violet, employing in each instance a measured and equal amount of ultra-violet. After ten days' treatment in this manner, the animals were killed and examined. Radiographs of the epiphyses and chemical analysis of the blood definitely indicated that while both parts of the spectrum exerted curative action, the shorter region, comprising radiations 2500 to 2800 inclusive, was the more potent.

In addition to these experiments, ultra-violet light of one wave length, i. e., monochromatic light, was employed in the antirachitic activation of cholesterol, which in turn was fed to a series of rachitic rats maintained on a rachitic diet. Three typical wave lengths were studied: 3130, which had been previously found to be at about the upper limit of the effective ultra-violet; 3025, a wave length in the sun's spectrum known to have strong antirachitic property; and 2800, a strong wave length of the quartz mercury arc, not found in sunlight. These experiments demonstrated that the wave lengths 2800 and 3025 both exerted marked potency, whereas the band at 3130 produced no distinguishable healing. Dr. Hess' conclusions are that 3130 A. U., just below the lowest limit of transmission of ordinary window glass, should be considered about the limit of the effective ultra-violet for rickets; and that radiations shorter than those found in sunlight are more potent in healing rickets than the effective area of the solar rays.

It becomes evident from these experiments that it is not sufficient simply to specify ultra-violet radiation for alleviating rickets or for controlling normal calcium and inorganic phosphorus of the blood. There are present long wave ultra-violet radiations, in both the sunlight and in light from artificial sources, that have no detectable effect on these conditions. It can be seen that it is of very great importance that the effective wave length be known and specified; and that it is essential, if any result is to be obtained, that an effective wave length be present in the light source employed.

A great part of the ultra-violet of sunlight lies in that portion of the spectrum that is not effective in rickets and that will pass readily through ordinary window glass. These radiations are still an unknown factor in promoting health. It is hoped that research now in progress will give some inkling as to their value.

The importance of the short ultra-violet radiations of sunlight, which will not pass through ordinary window glass, in promoting calcium metabolism and in curing rickets, has led to the development of a number of window glass substitutes.

THE NEW WINDOW GLASS OF NO VALUE IN WINTER MONTHS

These have been widely advocated as a means of enabling the short ultra-violet rays of winter sunlight to enter the office, factory and home. In view of the fact that the shortest ultra-violet wave length available in the winter months in the latitude of Newark, N. J., is 3070 A. U., and that this is present in only infinitesimal intensity, it can readily be seen that there is not a very large quantity of ultra-violet between the lowest detectable limit at 3070 A. U. and the limit of transmission of window glass at about 3200 A. U. Indeed the intensity of the ultra-violet of winter sunlight between 3070 and 3150 is so exceedingly low that its quantity can only be estimated and not measured with any degree of accuracy. In view of these considerations, it can be seen that there is not much available short ultra-violet during the winter months to find ingress into a room through an open window, even when the sunlight is direct. In congested districts, where there are many large buildings crowded together, many windows must receive their light not directly but by reflection from the walls of other buildings. Construction material such as brick, concrete and paints are poor reflectors for the short ultra-violet light. Consequently, those windows can receive, even at the best, but a negligible quantity of short ultra-violet. If then, in addition, this light must pass through a protecting glass, the amount of short ultra-violet entering will be still further decreased by the lowered transmission of the glass. It appears to be doubtful whether, by using such a glass substitute, there can be introduced into a room during the winter months sufficient short ultra-violet to be an aid to health. Recent experiments reported by Dr. Tisdale of Toronto have indicated that these special glasses are of no value during the winter months of December, January and February in the prevention or cure of rickets. In view of these considerations it is believed that they should not at present be advocated as an aid to health during the winter months.

SUNBURN EVIDENCE OF SHORT ULTRA-VIOLET RADIATIONS

It happens by coincidence that the radiations of sunlight effective for rickets and calcium and phosphorus metabolism are the same rays that produce sunburn and tanning. The production of a sunburn by sunlight is always evidence, therefore, of the presence of short ultra-violet radiations. Sunburn itself is a visible result of a biological reaction, and there is no evidence to indicate that it is associated with any of the other biological changes that may be produced by light. It is the common experience of everyone that sunburn is not produced by sunlight coming through ordinary window glass. In the laboratory, with suitable apparatus, it can be demonstrated conclusively that the

long wave limit for the production of sunburn is about 3130 A. U. It is also found that the most effective radiations for producing sunburn are the very short ones of sunlight, and that this accounts largely for the fact that sunburn is produced more readily in summer than in winter.

It might be added here that contrary to generally accepted belief, the ultra-violet wave lengths still shorter than those found in sunlight and produced by artificial sources such as the quartz mercury vapor arc lamp have very little sunburning action. The strong sunburning action of these lamps is due, not to the fact that they contain rays shorter than those found in sunlight, but to the fact that their light radiations are very intense in those rays of the sun that produce erythema and sunburn.

INFLUENCE OF ULTRA-VIOLET ON ANEMIAS

The further effect of ultra-violet on anemias, and especially pernicious anemia, has been studied by Dr. Macht of Baltimore and a number of collaborators. He found that the blood serum of pernicious anemia patients is distinctly toxic to plants, whereas that of ordinary anemia is not. Incidently, he irradiated some of the pernicious anemia serum with ultra-violet rays, and found that with such treatment it was possible completely to destroy the toxicity. The rate at which this can be accomplished can be greatly increased by employing sensitizers such as eosin or hematoporphyrin, the latter being a blood pigment. With the aid of a number of collaborators in sanitariums and hospitals, he was able to examine blood serum of a large number of pernicious anemia patients before, during and after irradiation with ultra-violet radiations, and in every instance the toxicity of the blood disappeared after continuous treatment. In addition, the patients showed marked improvement.

Previously it had been noted that secondary anemias following hemorrhage were benefited by ultra-violet rays. In view of the new discoveries, it became apparent that the ultra-violet exerted marked influence on anemias in general. An investigation as to the effective ultra-violet wave lengths in pernicious anemia is now in progress.

NECESSARY RESORT TO LIGHT FROM ARTIFICIAL SOURCES

These experiments on rickets, calcium metabolism and anemias indicate that ultra-violet radiations are a very important factor in promoting and maintaining normal healthy blood. It is not surprising, therefore, that the doctor, realizing this, is turning more and more to ultra-violet to aid him in assisting his patients back to health. The variability and inaccessibility of the sun's ultra-violet have, however,

resulted in the doctor, hospital and sanitarium employing to a large extent artificial sources. These sources are not a true substitute for sunlight, but they are of value therapeutically for the reason that a wave length has the same effect, provided time and intensity be correct, regardless of its source. It is only a matter of time when the proper wave length for promoting a certain condition will be known. It will be possible to administer these wave lengths and at the same time filter out any that may have objectionable action. But before this situation can be attained there is a vast amount of research work to be done, not only in the medical and biological field, but in the physical field, for there exists at present no practical methods of separating wave lengths or groups of wave lengths except in the laboratory.

Unfortunately the benefits of natural sunlight can be enjoyed only by a few. This is especially true during the winter months and in the heavily congested areas. The present indications are that it will be only a matter of time until artificial sources, such as the quartz mercury vapor arc lamp, will be familiar equipment in the home, and will be used regularly under the guidance of the family physician. This latter provision will probably be necessary, for in order to save time in the bustling life of the city, a high intensity source is necessary, and just as it is possible to over-eat or over-drink or over-indulge in anything, it is possible to over-indulge in ultra-violet light. The power to do good is also the power to do evil, unless judiciously used. The physician should serve as a guide in preventive as well as in curative medicine.

THE THERAPEUTIC WONDERS OF SUNLIGHT

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The work of the physician has always been, from its very nature, intensely individualistic. Human lives, not human *life,* have been his paramount concern; to save, where possible, an individual from the hand of death, regardless of its value or influence in that society to which it is being returned, has been considered his duty. If a physician here and there holds private views that would suggest a different course of conduct, the ethical code of his profession and the laws of the land conspire to keep him in the straight and narrow path of orthodoxy.

Many and various are the theories as to the best method of dealing with those members of society who are below the average in health and mentality. There are those who follow the cult of the superman, who would consciously and deliberately weed out all the unfit to improve the race. If his ideas were followed to their logical conclusion, most of our hospitals, as well as our institutions for the criminal, the deficient and the unfortunate, would be done away with and replaced by huge lethal chambers, working day and night, to eliminate the weaklings and the undesirables. At the other extreme, we have the optimistic humanitarian, who favors giving to the most vicious and unfit opportunities for betterment, believing that most of them would thereby rise to higher levels. Between these extremes there must be a half-way course of sanity and wisdom, which course can be followed with benefit to the human race without sacrificing to too great an extent the sacred rights of the individual.

That is the course that we, in our fight against tuberculosis, are humbly striving to find and follow. While we may interfere with the tuberculous individual to the extent of requiring him to change his habits of living, or perhaps to be confined in an institution, at the same time he is not denied any opportunity of winning for himself a few more years of life and happiness. Moreover, he is given every aid in fitting himself into his new environment and new habits of life.

We have only to glance through the pages of history and biography to see what great contributions have been made to society by persons suffering from chronic disease. Every alleviation of the illness of such persons enables them to accomplish greater and better things. Like the Hebrew patriarch of old who sometimes entertained angels unawares, so in reclaiming the tuberculous we may often be giving geniuses to

the world. A single Robert Louis Stevenson or Livingston Trudeau would tip the scales against a score of healthy human animals who spend their strength for selfish satisfaction only.

In the consideration of race improvement it may be argued that any discussion of methods of treating disease such as tuberculosis is irrelevant, since, if such treatment be successful, it involves the returning to ordinary life of many individuals only partly fit to take up their share of responsibilities. It is not the intention of the writer to agree that this is true. However, right or wrong, sanatoria will very likely continue to treat many individuals who cannot possibly be returned entirely recovered. So rather than enter into a controversy on this point, it seems that much can be accomplished by showing how the results of treating such disease as tuberculosis are applicable to the more direct method of race improvement, viz.: to the prevention of disease and thereby to the building up of the physical and mental fibre of the race.

THE MODE OF CURE

The results of many years of sunlight treatment of tuberculosis and similar infections seems to show quite definitely that the mode of cure of a tuberculosis patient is in the improvement of the general condition of that patient by the mild stimulation of processes that sunlight produces; the individual, in his improved condition, then combating the disease himself by his own defensive mechanism. His gain in his local and general physical condition is accompanied not only by a gain in resistance to further infection, but also by a distinct improvement in his mental attitude. Since this is true, apparently, irrespective of the type of disease or infection with which the patient may be afflicted, it must follow that it is also true for the normal or nearly normal individual exposed to the same therapeutic measures.

Sunlight thus constitutes a very important prophylactic measure and one that can be used in a very direct fashion for race improvement. While the therapeutic value of sunlight has been recognized as far back as history records, it is only in the last decade that light treatment has begun to be used extensively.

Not very long ago, the pioneers in this field were repeatedly called upon to defend and to justify the use of light in the treatment of disease. But times have been changing rapidly. Now, it seems, the value of light, both as a prophylactic and as a therapeutic agent, is so universally recognized that it falls into the category of things that are taken for granted. It may be that the pendulum has swung too far the other way. Whether for good or for evil, the popular press has seized upon it as a timely subject and has broadcasted its virtues far and wide,

so that the use of light, both as a therapeutic agent and as a prophylaxis, promises to become quite the fashion, as appendicitis operations were a few years ago.

While heliotherapy is valuable in most conditions in which the resistance is low and the body needs to be built up, its principal use at our institution has been directed toward the treatment of so-called surgical tuberculosis.

THE BUILDING OF STRENGTH AND RESISTANCE

We shy at the term "surgical tuberculosis" because it tends to perpetuate the old erroneous idea that the sufferer from tuberculosis of any part other than the lungs was a proper subject for surgery. Theory and experience have combined to show the futility of the old classical treatment. On the theoretical side, it is clear that a general disease must be treated by building up the strength and resistance of the body as a whole. It is useless to remove a superficial focus of infection when other hidden foci in the body elude the surgeon's knife. Besides, there is the possibility of spreading the invading organism from one part to another. On the practical side, the results of surgical treatment were in most cases so deplorable that one wonders why physicians continued to employ it for so long a time. Perhaps a few specially hardy patients survived the operation and struggled back to comparative health, but in the vast majority of cases the consequences were mutilation or deformity, non-healing, suppurating sinuses, and life-long invalidism.

It was the contemplation of these unfortunate results while acting as an assistant to the famous surgeon, Dr. Kocher, that led Dr. Rollier to cast about for a more effective treatment of tuberculous disease. The success in this quest is evidenced by the great army of followers, both in Europe and America, that have rallied to his banner.

ARTIFICIAL SUNLIGHT

In the northeastern part of the United States in which we live, our greatest drawback in carrying on our work is the climate. Even in the spring and fall there are whole weeks at a time when the sun shines very little, and in winter bright sunshine is the exception rather than the rule. But ever since our primitive ancestors stole fire from heaven, man has been more or less successfully employed in trying to conquer Nature. He accepts the gifts but "sidesteps" her restrictions. Thus it came about that as soon as Rollier's method of heliotherapy began to gain recognition, various kinds of lamps producing artificial light for treatment of disease began to appear on the market.

Just here I wish to pay tribute to our noted pioneer and worthy contemporary, Dr. John Harvey Kellogg, who has played such an im-

portant rôle in bringing about the proper recognition of the value of light in disease. His success has been an inspiration to all of us. We owe a great debt to him.

In the last few years the varieties of therapeutic lamps have become so numerous and the claims of their manufacturers so insistent and extravagant that every physician finds himself confronted with the necessity of looking into the matter for himself. Hence, the relative advantage of artificial light and natural sunlight became a timely topic for discussion.

The medical literature of the day discloses that additional therapeutic uses for light are constantly being discovered. It is probably true that in the treatment of some diseases certain portions of the spectrum are especially effective—one might almost say "specifically" effective. In such cases it is conceivable that artificial lights particularly strong in these portions of the spectrum might be equal or superior to natural sunlight. But I am speaking now of the relative value of natural and artificial light in tuberculosis only. This is the field in which most of my observations have been made and in which I feel justified in expressing an opinion.

THE EVIDENCE FURNISHED BY EXPERIENCE

The conclusions arrived at after fourteen years' observation of heliotherapy and various other forms of light treatment can be summed up by saying that Nature is hard to beat at her own game. None of the artificial lights so far produced commercially have seriously rivaled the sun itself in the treatment of tuberculosis. As things now stand, to discard heliotherapy in favor of lamps would be as illogical as to shut out the light of a bright noonday and work by electric light. We do not base our belief merely on casual observation, but on careful examination of the patient's condition before and after the course of treatment. A good tan may be obtained, but the skin lacks the velvety smoothness and suppleness that one notes in skins tanned by the sun. There is not the muscle development with the artificial light that there is with sunlight. In seasons when heliotherapy is impracticable owing to clouded skies or lowered air temperature, artificial lights supply, however, a real need and their use at these seasons is to be recommended.

Most of the lamps employed belong to one of two types, the mercury vapor or the carbon arc. The spectrum of the light from the mercury vapor lamp being somewhat rich in ultra-violet rays, this type attained considerable popularity among those persons who entertained the widely prevalent idea that the active healing principle lay in the actinic portion of the spectrum alone. This same theory gave rise to

the idea that sunlight at a high altitude was more efficacious than sunlight near the sea level, because of its greater proportion of ultraviolet rays. But, to the best of our knowledge, this special effectiveness of the actinic rays has never been adequately proved as far as tuberculosis is concerned; it remains merely an unsubstantiated theory, which we do not wish to deny but which we are not willing to accept without demonstration. Lacking scientific proof, we are compelled to fall back on our experience, which has furnished ample evidence of the greatly superior results obtained by natural sunlight.

THE IMPORTANCE OF GENERAL HYGIENIC LIVING

One cogent reason for the superiority of suncure over lamp treatment may be found in the very nature of the disease under consideration. For tuberculosis, although it may be manifested by lesions in many different parts of the body, is *not* a disease of the part manifestly affected, but of the whole system. For this reason, the aim of the physician must be to build up the patient's general physical condition by placing him in an environment where the conditions of hygienic living will be met. In what better way can this be accomplished than by heliotherapy that presupposes a course of treatment in a sanatorium or the duplication of sanatorium conditions in a patient's home?

Perhaps in our enthusiasm over suncure we have attributed too much virtue to the light itself, and too little to the other health-promoting agents connected with it. This error has given a loophole for the insidious suggestion that all the patient need do to get well is to sit or lie for an hour or two each day under the rays of the lamp, and then spend the rest of the time as he pleases. We should be only too glad if this were true. It would greatly simplify the treatment of tuberculosis by eliminating the necessity for long periods of enforced idleness, so irksome and financially embarrassing. But facts have too often proved it to be a fatal delusion. Without the tonic effect of moving air on the naked body, regular hours, suitable diet, and, above all, *rest,* light rays are robbed of much of their beneficial action. The patient's time is wasted and his disease advances to a stage where a cure is very difficult.

SUNCURE TECHNIQUE

As for our suncure technique, detailed descriptions of the approved procedure have been published repeatedly in pamphlet form, and there is now on the market a good English translation of Rollier's latest book on the subject. There are a few salient features, however, that might be emphasized here.

Since tuberculosis is a disease of the whole system and not solely of the part manifestly affected, the whole body should be exposed to

the sun's rays. This should be done gradually, however, and after suitable preparation of the patient and study of his case. The first exposures should be very short, and of the feet only. Then both the time and the amount of body surface exposed are gradually increased until the whole body is being insolated about three hours daily. The length of time taken to reach this stage varies according to the delicacy or robustness of the patient and the sensitiveness of his skin to sunlight.

Adequate protection must be provided against cold and strong winds, which not only cause the patient discomfort but may lower his resistance to other infections. High, close fences and thick shrubbery make good windbreaks, but for weather when these do not suffice, canvas curtains on one or two sides of the bed prove a great help.

Special care and attention must be provided for the bone and joint cases, for no matter how well a lesion heals, it is evident that if healing takes place with the limb or joint in a wrong position, deformities will result. Casts are to be avoided because they keep the sun from the affected part and favor atrophy. But there are many other clever devices, such as tractions and hard pillows, that allow very little movement of the part but give free access of the sun and still prevent the assuming of faulty positions. In some cases the disease has progressed so far before suncure has a chance to take effect that deformities result in spite of every care. After the lesion is healed and the body has been built up, some of these cases of deformity can be at least partially corrected by surgery. This is an entirely different matter from the use of surgery as a regular treatment for the condition.

In general, it must be remembered that there is no suncure technique that will suit every case. Each new patient is a new problem calling for individual attention and study. The method that keeps a patient comfortable, contented, and progressing towards health, is the correct method for him.

In the course of our experience we have come to realize the insufficiency of the time unit in the measurement of dosage. The method of recording suncure dosage in terms of hours and minutes is undoubtedly open to the serious criticism that no account whatever is taken of variations in the intensity of sunlight from season to season, from day to day, or from minute to minute, or of differences in quality and intensity of sunlight in different parts of the country. Dr. Brian O'Brien, our physicist, has worked for the past two years on the more rational system of dosage based on sunlight intensity and we now have a method that is simple and promises to be quite satisfactory.

THE EDUCATIONAL INFLUENCE OF SUNCURE SANATORIA

Surveying our work in its relation to the Betterment of the Human Race, undoubtedly the most outstanding feature is the educational aspect. This educative influence embraces, not our patients alone, but the whole body of persons whose lives are touched by theirs. Their experiences and observations in institutions such as ours teach, as nothing else could, the transcendent value of such simple things as fresh air, good food, regular and moderate habits of living, and, above all, God's own sunshine. One need only glance through the pages of our papers and magazines to be convinced that sun baths and other light treatments are seizing the fancy of the public to a surprising extent. Notoriously faulty though the popular press often may be in its statement of facts, nevertheless, in this instance, we think the benefits will far outweigh any unfortunate results.

So interested are people becoming in light that many persons who are planning or erecting buildings for human occupation are considering fitting them with windows of one of the new kinds of glass claimed by their manufacturers to be transparent to a larger range of the spectrum than ordinary glass, especially to the ultra-violet rays. We have received several letters asking the opinion of our physicist on these glasses. He considers that, provided the expense is not prohibitive, it would be well worth trying. Persons using this glass, however, must not think that opening windows has become unnecessary. Ultra-violet rays cannot take the place of fresh air and direct sunlight.

To return to the educational influence of suncure sanatoria, a woman who lives about seven miles from Perrysburg, having seen our sturdy, brown-skinned children running about undressed, and having been warned by her physician that her child had glands that were probably tuberculous, decided to give him suncure. To encourage him, she had her other children take the sun baths with him. At the end of the summer she declared that never had her family been so happy and free from ailments. Her friends, in turn, seeing the marvelous benefits enjoyed by these children, carried their enlightened ideas to their homes. And so the influence ever widens, until it embraces the whole race.

In conclusion, it should be emphasized that a large number of clinical observations point strongly to the superiority of sunlight over all forms of artificial light commercially available. There is, of course, a field for artificial light when sunlight is not available, and to meet this need efforts are being made to develop artificial lights producing a close approach to the sun. It is important to realize that even sunlight alone, without rest and other proper measures which accompany

it, is inadequate in dealing with tuberculosis, as it is inadequate in prophylaxis. Like any other therapeutic measure, light should be intelligently used, and not only should a systematic schedule of treatment be followed and proper allowance be made for any subnormality in the patient, but, if possible, accurate measurements of the light dosage used should be carried out. And it scarcely is necessary to add that sunlight, while of course not a cure-all, is a tremendously valuable adjunct to other methods of therapy and to other methods of prophylaxis aiming toward race improvement.

THE NEW EDUCATION

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Many persons among us use the phrase "The New Education" approvingly, while others use it ironically. Some of our people, college professors and laymen principally, are not pleased with present-day learning in American education. They are fearful that we are headed for the rocks because we are cutting loose from the moorings of the past, fearful that we are drifting with the winds of superficiality and commercialism. The proportion of those who are not in sympathy with the newer movements in education in our country is apparently decreasing, however, while the proportion of those who are heartily in accord with the changing objectives and methods in our schools is steadily increasing.

Whether fortunately or otherwise—some think one way, some another—American educational programs are plastic, so that they can and do respond to sociological conceptions and economic conditions and also to new developments in the sciences pertaining to human nature.

Until the present moment American schools have been leading the way in educational "reform," but just now the schools in Germany, in England, in Russia, and perhaps even in Japan, also are casting tradition aside and are reshaping their courses of study and their methods of instruction and of disciplining pupils. Those Americans who are becoming alarmed, because of the apparent abandonment of the ideals of mental discipline and culture in our educational work, might feel less hopeless if they would reflect on the fact that the European and Oriental countries are remodeling their educational systems and procedures upon the American system as their model. This is not said by way of boasting, of course; it is mentioned merely as a significant phenomenon in the present agitation respecting educational objectives and policies in all advancing nations.

STATIC AS CONTRASTED WITH DYNAMIC KNOWLEDGE

During the last twenty-five years or so in our country we have been increasingly stressing the view that the storing-up of knowledge for the purpose merely of acquisition is not a worth-while objective in education. Learning for the sake of possessing facts that play no rôle in facilitating the adjustments of daily life does not today enjoy the prestige among us that it did in an earlier day. This writer can remember the time when men who were spoken of as "learned" were highly

regarded. They were deferred to by their associates. In the community in which the writer spent his boyhood there were several persons who were reputed to be able to speak and read, after a fashion, two or three foreign languages. Though they were not distinguished in any other way, they were held up as models to the rising generation. They did not play any conspicuous rôle in the social, economic, industrial, political, or educational life of the community. At least they did not promote the welfare of the community in any tangible way; and yet, because they possessed a kind of knowledge which was not possessed by other people, they were looked up to and referred to with respect.

In this same community today, the type of person who acquires knowledge that is not functional, so that he does not use it to promote the welfare of the community, is completely ignored. He is regarded as a neutral factor, and possibly even as an encumbrance. In twenty-five years there has been a reversal in this community respecting the importance that is attached to static as contrasted with dynamic or functional knowledge. And what is true in this community is true at least in some measure throughout the country.

Whether we approve of it or not, it is nevertheless true that we are today exalting competency, capability, efficiency, in every-day life. We overlook, if we do not censure, those who cannot pull their own oar or who do not contribute to the well-being of the community in which they live. Formerly we thought highly of those who were said to be widely read, but now unless their reading issues in dynamic activity, we rather condemn than praise them. We are emphasizing the importance of *action* as contrasted with mere static accomplishment.

It is significant that other advancing countries are patterning after us just now. If we are on the wrong track, our penalty will be grievous because we may be leading the whole world astray. It is not intended by this remark to cast doubt on the wisdom of the course we are pursuing, because the present writer is whole-heartedly in sympathy with the main trends in American education; but it cannot be overlooked that there are some keen and serious people among us who are apprehensive concerning the outcome of the changes that are taking place today in our courses of study and in our methods of instructing and training the young.

WE ARE RECONSTRUCTING OUR COURSES OF STUDY ON A FUNCTIONAL BASIS

Anyone whose educational memory extends back twenty-five years knows that the course of study in our schools and colleges is a very different thing today from that it was a quarter of a century ago.

The program of studies has been greatly enlarged, but this is not the most important change that has taken place. The traditional studies have been and are still being pruned until some of them do not bear much resemblance to their original form and figure. Spelling, for instance, has lost from one-half to two-thirds of its original components. English grammar as now taught is not much like the grammatical course of twenty-five years ago. Arithmetic has resisted the pruning knife more successfully than some of its contemporaries, but it has not escaped curtailment by any means, nor has any other study that occupied a position of prestige in the elementary or secondary school twenty-five years ago. The slogan of the pruners has been and still is, "Let us reject everything that will not be used in daily life, so that we may make room for new knowledge that is necessary in order that an individual may understand the world in which he lives and be capable of adjusting himself to it by reconstructing it so that it will the more fully meet his social, intellectual, physical, and aesthetic needs.

THE RÔLE OF THE NEW PSYCHOLOGY IN DETERMINING EDUCATIONAL METHODS

Until recently it was generally believed that the mental faculties could be strengthened or polished or sharpened by exercise of any sort. The psychological and educational literature that was in vogue twenty-five years ago was full of the conception that the mind is like a muscle; it will grow strong with use, and the strength that it acquires by exercise in a specific way can be employed in every way whatsoever. It followed from this doctrine that the aim of education should be principally to strengthen the mental powers, and that studies requiring the most strenuous effort to master were the most valuable. Subjects that could be acquired easily were comparatively worthless because the mind could not gain much strength in appropriating them. It was not thought important that a pupil should be interested in any study. Indeed it was better that he should not be greatly interested in it because he would receive salutary discipline in forcing himself to master educational material that did not appeal to him for its own sake. That is, the power acquired in performing drudgery in the schoolroom could be stored up and utilized without loss whenever it was needed in after life.

Modern educational psychology has given a quietus to the doctrine that mental power acquired by specific exercise can be drawn upon for service in a general way. Ability is specific. The individual who has learned to spell 15,000 words, say, has gained ability in spelling, but he has not thereby improved his faculty of dealing with people except

in so far as he is placed in social situations in which he will be required to spell a large number of words. Mental power developed by application to arithmetical problems for an hour a day for eight years will be confined almost entirely to arithmetical situations and will be of but slight value in any other kind of situation.

There is still some debate in psychological and educational circles regarding the extent to which mental habits acquired in dealing with one kind of situation will be of service in dealing with other kinds of situations; but, even if there is some "carry over," it is not considered to be of much importance.

And, it is not playing any considerable rôle in our country today in determining educational policy. The psychologist says to the educationalist, "Determine what you want pupils to be able to do outside of school. Then train them in school with specific reference to what will be required of them after school. Choose material of instruction that will relate as directly as possible to after-school situations. Eliminate topics that, as far as you can see, will not play any part in the individual's adjustments outside of school. As the conditions of life change, see to it that courses of study are modified by way of deleting topics that no longer bear upon the adjustments of daily life, and also by way of introducing materials that relate to the new social or physical situations that the individual must encounter. Do not let your courses of study become fixed and immutable so long as there are changes taking place in the individual's environments. Keep the school as closely as possible to the sociological, economic, industrial, and physical environments of those who are being educated." And the educationalist has listened to the psychologist and has followed and is still following his advice.

ADAPTING EDUCATION TO INDIVIDUAL ABILITIES AND NEEDS

Accepting two principles, that the school should prepare for the needs of every-day life and that knowledge acquired in the school will not be functional outside of the school unless it bears directly upon the situations in which the pupil will be placed—accepting these two fundamental principles, the policy of varying educational materials and procedures to meet individual needs becomes imperative.

At the secondary school in which the present writer made preparation for college, every pupil was put through the same régime, not simply because we were all preparing for college but more particularly because it was believed that what was good or best for one was good or best for all. It was believed that there was a preferred course of study and that everyone should pursue it in order to gain mental power and also culture in most liberal measure. Such a view is no longer

entertained. In the academy just referred to, there are now several courses of study with freedom of election, whereas formerly there was but one course; and it is not considered that any one course is inherently superior to any other, although there is probably still a lingering belief in the minds of some persons that the classical studies afford better discipline and more culture than any " modern" study. The pupils in that school now pursue courses with special reference to the program they wish to follow after completing the secondary school, rather than with reference to securing either formal mental training or formal culture.

And what is true in respect to the change that has taken place in that school is equally true in secondary schools throughout the country It is true also in the colleges. Fifty years ago there was one course in all colleges, whereas there is no best course in most colleges and universities today, although there are two or three institutions in which the policy is still followed of offering only so-called disciplinary and cultural courses.

It is recognized today, of course, even by the most radical educationalists—radical in the sense that they attach little or no value to any educational material that is not adapted to prepare children for the actual needs of life—that all individuals have some needs in common, the need of being able to read, to perform fundamental arithmetical operations, to write a grammatical sentence, to understand some of the laws of Nature that operate constantly about them, and so on. Generally speaking, it requires six or seven years for children to gain possession of materials that will be of service to everyone in present-day life, and so there is not much, if any, election in the elementary school course.

Not only are the special needs of the individual being provided for but his special abilities are also being taken account of. American educational psychologists have been drumming it into the minds of those who are responsible for our educational policies that ability is a specific thing and that particular abilities vary in individual cases in the degree of their development. The sociologist now comes forward and says that the well-being of such a complex society as we have developed in this country will be promoted if an individual who has ability in particular directions is encouraged to develop this ability to the utmost so that he may utilize his ability for the benefit not only of himself but of the group of which he is a member.

So just now we are in the midst of experimentation for the purpose of discovering how we can organize and conduct schools and colleges in such a way as to conserve and bring to fruition special

abilities, while at the same time nurturing more general abilities so that individuals may live together and each one be capable of doing all the things that are necessary for everyone to perform in order that he may not be alienated or eccentric to the extent that he cannot adjust himself to the group.

THE METHODS OF DYNAMIC INSTRUCTION

One who had his schooling twenty-five years ago, and who visits a school of the new type today, is usually struck by the new methods of instruction and of discipline. Children are often seen working in groups together, or planning or executing some project, instead of merely memorizing the contents of their textbooks. Within the school they are discussing or handling problems that they have found outside the school. They are active and dynamic, rather than receptive and static.

Suppose pupils are having a lesson in measurement in arithmetic. The chances are that they are learning how to measure by solving actual problems of measurement, perhaps in finding the dimensions of the schoolroom, or the number of square feet in the floor area, or square yards in the playground area. Or maybe they are finding out by actual experiment how many pint measures it requires to fill a quart or a gallon measure, and so on. They will probably learn tables and rules, but not until after they have constructed them concretely so that they know from first-hand experience what the data or procedures covered in a table or rule actually mean. If the pupil is studying algebra, he will probably be found using it in the way in which it is designed to be used in science or in mechanics. If he is studying Latin, he will be tracing the influence of Latin words or constructions upon the meaning of English words and grammatical forms, or he will be noting the appearance in English literature of expressions and mythological, political, and other conceptions current in the days when Latin literature was developing. If he is studying spelling he will be acquiring automatic use of the words he will actually employ in written expression by writing them in the types of constructions he will be likely to employ in daily life. If he is reading, he will be having experience in gaining the meaning of sentences, paragraphs, and selections as quickly and accurately as possible without pronouncing the words aloud; he will probably be expressing the meaning of his reading dramatically or in some other concrete way before he actually reads a passage aloud. And so on throughout the entire range of modern school work.

American teachers are planning their methods of instruction in view of the psychological principle that whatever a pupil has done in

school he can do outside of school, but if there is much of a break between school and life, what is gained in the former will not be utilized advantageously in the latter. Ability is specific and not general. Perception, memory, reason, imagination, motor skill, are all dependent upon the specific experiences by which they have been developed. A botanist may be marvelously keen in noting the characteristics of any form of plant life, but he may be marvelously dull in noting the distinguishing characteristics of human beings, of grammatical constructions, and so on, *ad libitum*.

And the principle applies to every specialist. It applies equally to the methods of acquiring any material in the schoolroom. If a girl has studied cookery in school by learning rules from a textbook and reciting them in class, she cannot go into her own kitchen and apply what she has memorized without great loss, to say the least.

The principle applies as well to one's social as to one's arithmetic or Latin or history lessons, so that the "new" education aims to have pupils learn how to live together cooperatively by actually working and playing together in the classroom and on the playground. A pupil recites to and with his classmates, and not simply to the teacher. He learns to play fair outside of the classroom by having experience in restraining selfishness, and in cooperating, in the classroom. The group reacts upon the individual, approvingly when his conduct is of a social type, but condemningly when he tries to take advantage, or is underhanded, or is unwilling to pull his own oar.

SELF-GOVERNMENT IN THE "NEW" SCHOOL

The contrast between a representative modern school and one of twenty-five years ago in respect to the attitude of the teacher toward his pupils is marked. In earlier times the teacher was a disciplinarian; he governed his school in an autocratic way. He had many rules, with prescribed penalties for the infraction of any of them. When the present writer began to teach, he inherited from his professional ancestors the policy of setting before his pupils, on the first day of school, fixed rules regarding communication during school hours, leaving one's seat without permission, copying the work of any neighboring pupil, "snickering" in school, failing to prepare each lesson within the scheduled time, being tardy at school, and so on. Teachers were accustomed to make an inventory before the opening of school of the misdeeds of which pupils were likely to be guilty, and then to lay down the law concerning each of them. In a representative school today, there may be no explicit rules of behavior. Pupils know that they must play fair with the teacher and with their fellows. There being no explicit rules to break, they are not thinking so much about breaking

them. Twenty-five years ago teachers took the attitude that pupils had to be coerced to apply themselves to their studies and that they were naturally inclined to be mischievous and so had to be restrained by penalties. Today teachers assume that pupils will be interested in their work so that it will not be necessary to give very much attention to the correction of disorder or of misconduct. If given proper opportunity, pupils will be self-directive and self-propelling to a large degree.

It is not the intention of the writer to convey the impression to the reader that we have reached the millennium in our educational work. Pupils can be found in the schools who would rather not be there and who have to be compelled to master the materials of education. There is some mischief going on in representative schools that has to be restrained. Pupils do not always play fair in their relations with their classmates and with the teacher. Not all that is taught, in the elementary or high-school, functions in the out-of-school life of pupils. Pupils do not attack with avidity everything that is offered in the school room. But comparing the representative school today with the representative school of twenty-five years ago, we have progressed a long distance in all these respects, and we are still headed forward.

THE CONTRIBUTION OF HEALTH EDUCATION TO RACE BETTERMENT

THOMAS D. WOOD, M.D., Professor of Health Education, Teachers' College, Columbia University

Health education provides the mechanism and procedure by which the efforts toward improvement of the length, quantity and quality of life and the health of the individual and of the race may be made effective in the conduct of human beings.

Health is abundance, soundness and worthiness of life. As stated in the Health Education report of the National Education Association and the American Medical Association, "The ideal of health is not mere freedom from obvious deformities and pathological symptoms. It is the realization of the highest physical, mental and spiritual possibilities of the individual."

There are three ideas or standards of personal health:

(1) Health ideal. This is the perfect health that one imagines and would like to have. This is very rarely and perhaps never wholly attainable.

(2) Health actual. This is often far below the optimum and the possible for the individual.

(3) Health attainable. This is the health that the individual might achieve with the knowledge, appreciation and realization of health that are reasonably possible.

It may be assumed that one prominent purpose of all programs for health improvement, as well as of this Conference, is the lessening and bridging of the gap between health actual and health attainable for the individual and for the race.

WHAT HEALTH DEPENDS UPON

It may be stated that health depends upon and is determined very largely by:

(a) Germinal inheritance and pre-natal influences.

(b) Healthful nurture and environment after the birth of the organism.

(c) Practice of the procedures of personal hygiene that affect not only physical but mental, emotional, social and character health.

(d) Immunization against the infections for which specific prophylactic and preventive inoculations have been demonstrated.

(e) Discovery and correction of remediable health defects and handicaps.

(f) Application of safety measures for the prevention of controllable hazards and accidents.

(g) Health education as a program of training to insure the appreciation and application of the scientifically approved measures for the promotion of health.

THE AIMS OF HEALTH EDUCATION

Health education, to provide for all the factors in healthful living just enumerated, should continue throughout the life of the individual, but the foundations must or should be securely established in childhood and youth.

Health education is the sum total of experiences in school and elsewhere which favorably influence habits, attitudes and knowledge relating to individual, community and racial health.

As approved and recommended by the Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association, with the cooperation of the Technical Advisory Committee of twenty-seven members, the aims of health education may briefly be stated as follows:

1. "To instruct children and youth so that they may conserve and improve their own health.

2. "To establish in them the habits and principles of living that throughout their school life, and in later years, will assure the abundant vigor and vitality that provide the basis for the greatest possible happiness and service in personal, family and community life.

3. "To influence parents and other adults, through the health education program for children, to better habits and attitudes, so that the school may become an effective agency for the promotion of the social aspects of health education in the family and community as well as in the school itself.

4. "To improve the individual and community life of the future; to insure a better second generation, and a still better third generation, a healthier and fitter nation and race."

DIFFICULTIES OF HEALTH EDUCATION DURING CHILDHOOD AND ADOLESCENCE

The purpose of this paper is to consider briefly health education during the period of childhood and adolescence. Some conscious provision should be made for health education each year, each month, each week, and each day in the life of the infant, child and the youth. Observation and experience with the health education programs of the schools today makes more clearly evident certain difficulties and obstacles in carrying out successfully a comprehensive program of health education, even if this is limited to elements accepted as essen-

tial not only by special teachers but by all of those qualified by training to decide upon the contents of this program. Some of these difficulties may be stated thus:

(1) Health education deals with the fundamentally most *important* and the least exact of all the applied sciences.

(2) Health education, if successful, should begin on the day the child is born, and the foundations of this phase of education during the first four to six years of life are in many respects the most important of all the stages in this process. Since parents in the large majority of instances are utterly incompetent for the health education of their own children, with rare exceptions the child enters the first grade of school without the foundation and background in health habits and attitudes that are of fundamental importance, and that should be established in the home before this period.

(3) Up through the succeeding periods of childhood and adolescence, the great majority of children are seriously retarded in their progress in health education. This, then, presents the difficulty to the schools of trying to educate, in relation to health, seriously retarded pupils.

(4) With few exceptions, the teachers in the schools are less well qualified to perform their parts in the health education of the children under their instruction than to teach the other subjects in the curriculum.

(5) The teaching of health, while subject to the general laws and principles of psychology and progressive education, presents special problems that are for the most part not yet successfully solved.

These, then, indicate some of the prominent difficulties and obstacles to a successful procedure in this field of health instruction.

CONDITIONS IMPORTANT IN HEALTH EDUCATION PROGRAMS

Within the brief time available here, the following conditions are suggested as fundamentally important for satisfactory health education programs in the schools:

(1) As the foundation for the health education of children and youth, as previously defined in this paper, a satisfactory program of health service is essential. Health service as distinguished from health education includes the measures carried out to discover the health status and needs of the children and to secure the conditions requisite for the best state of individual health of which the child is capable. The program of health service includes:

(a) Daily health inspection in school and at home for the prevention and control of communicable disease.

(b) Periodic and the more frequent health examination and tests of the child by weighing and measuring, to insure the most favorable growth and development of the individual.

(c) The correction, by the school and by the home (and through the cooperation of other agencies) of all remediable health defects found in pupils.

(d) The maintenance of a sanitary environment in the school and outside.

(e) Immunization against various forms of infection.

(f) The maintenance of a healthful school in administration, management and programs.

(g) Provisions for first-aid and safety.

(h) Health supervision of teachers, janitors, and any others who come into contact and association with school pupils.

(2) Health education represents inevitably a program as wide as the child's day, and as wide as the hours spent in school. The successful training of the pupil in various phases of health must be undertaken by the individual in school who knows most about the pupil and who is for the greatest number of hours associated with the school child. It is increasingly evident, therefore, that in the kindergarten, and in the grades of the elementary school, the classroom teachers must undertake the fundamental task of health education. If they are to be reasonably well prepared for this important phase of the school program, they must be as well trained and qualified as possible for this work of health instruction and training. At present they are relatively very inadequately prepared.

THE NEEDED TRAINING OF TEACHERS

The teacher training institutions should give to all their students thorough grounding in the natural and biological sciences, with definite instruction in nutrition and bacteriology. These students should also be trained in the essentials of human anatomy, physiology, hygiene and public health. Their instruction in educational psychology should be followed by grounding in the elements of mental hygiene. They must be well trained also in the practical procedures involved in the health service and health supervision of the schools. On the basis of the courses here indicated, student teachers in training should become familiar with the principles and methods of practical health teaching. Our normal schools and teachers' colleges have very important progress to make in relation to this part of the professional training of their students.

(3) Health education requires in a peculiar degree the best technical supervision that can be provided. If the health teaching is

educationally sound, the information given, while pedagogically satisfactory, must also be scientifically accurate. Continuous advice and guidance are needed by all teachers in the elementary schools who are engaged in health instruction.

SYMPATHETIC SUPPORT INDISPENSIBLE

(4) Sympathetic understanding and substantial support of health education as a fundamental part of the curriculum of the schools is indispensible not only on the part of teachers but by superintendents, members of boards of education, boards of health, parents of the pupils, and socially minded and responsible citizens in general.

Marked limitations and difficulties, in the present attempts in health education in the high schools, point clearly to the necessity of having all courses in the curriculum and all of the activities of pupils contribute wherever possible to the work of health education. Just as health teaching in the elementary grades should, within reasonable limits, be diffused through the entire program of the school day, so health education in the high school, with departmentalized teaching, should be considered an interdepartmental problem and, as in the case of the liberal arts college or the teacher training institution, should be planned and supervised by an interdepartmental committee of those most interested in and best qualified to deal with this important subject. It is relevant here to mention the fact that in a classical report entitled, "Cardinal Principles in Secondary Education," prepared a few years ago by a special committee of general educational experts of the National Education Association, health was clearly placed as the first of the seven main objectives in secondary or high school education.

(5) Basic to intelligent health education in the schools, and in accord with progressive educational theory and practice, is a clear understanding and recognition of the concrete objectives and outcomes in health habits, attitudes and knowledge that should be clearly worked out not only on each level or grade of education in the schools, but also in adaptation to the special needs of the individual school and finally to the specific needs of the individual pupil. This method of approach to a course of study or a practical curriculum in health education involves a marked departure from the traditional form of academic course of study or material of instruction used in most of the schools.

SPECIAL METHODS MUST BE DEVELOPED

(6) Imperatively needed in this field are the discovery and application of sensible and effective *methods* of teaching health. While the general principles of psychology and pedagogy should be applied to

health education, careful study of this subject shows clearly that some special interpretations and adaptations of the principles and methods of teaching should be made in relation to the doctrine of interest, the stimulation of self-activity, and types of motivation to be employed in health education. The problem of successful method in health teaching has received as yet scant attention and apparently is very little understood either by educators, physicians or parents.

SOUND INCENTIVES VERSUS ARTIFICIAL MOTIVATION

The swing of emphasis from the former teaching of physiology and hygiene to the present day attempt to encourage health habits and healthful conduct in the pupils was a swing on the whole in the right direction, but at the present time too much artificial motivation of health habits of children is employed as compared with the use of rational sanctions and sound motives. Nowhere in the curriculum of the schools at the present time are questionable or objectionable inducements to thinking, feeling and action so much confused with sound incentives as in the field of health education.

(7) Of paramount necessity is favorable opportunity for health conduct. While the definition of health education gives logical prominence to favorable influence upon habits, attitudes and knowledge, far too frequently is there failure to appreciate the fundamental necessity for opportunity in home, school, or in the community, for pupils to live up to the best that the schools and the homes try to teach. For example, it is entirely inconsistent to teach children in the schools that they should wash their hands before eating a school lunch if there are not reasonably adequate facilities for the gesture of handwashing and provision of soap, hot water and sanitary towels for the real removal of dirt.

(8) The cooperation of the home with the school in this phase of the child's education has an importance that can hardly be exaggerated and that is as yet very little appreciated. By far the larger part of the child's opportunity for practising in health what he learns in school occurs outside of the school, in the home and in the community. Much more than half, then, of the possible opportunity in the health education of the child belongs to the agencies outside of the school. Very great emphasis must be laid, therefore, upon this mutual understanding of the problem and upon the more intelligent and effective coordination of effort between the home and school, and between these agencies and the other official and non-official agencies in the community that are or should be vitally interested in the health education of the child.

THE NEWSPAPER—THE MOST EFFECTIVE AGENT FOR ADULT EDUCATION

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The newspaper is the most effective agent for adult education now being operated for and by society. In the days of Plato, Socrates and Aristotle, this position was held by the spoken word. The principle medium, as far as we can judge by surviving tradition, was dialogue and dissertation. The invention of printing brought the domination of the spoken word to an end and established that of the printed word. By varying changes, the newspaper has come to its present position as the most effective machine for adult education. Nothing compares with it except the political campaign, the theatre, including the movie, and ordinary gossip and conversation. No one who experienced the campaign of 1896 can doubt the efficacy of a political campaign in adult education. But it operates intermittently. The theatre, including the movie, reaches only a small part of the people and then at intervals. Gossip and conversation are retail measures, and this is a wholesale age. Books reach relatively few people.

In order that a newspaper shall have outstanding value as an educational institution, it must have readers. It must, therefore, supply the people with that which interests them. In supplying the entertainment, amusement and diversion that people require, the qualities needed are wit, humor, inventiveness, skill of presentation, and a reasonable regard for good taste. Not much else is demanded. If they meet these requirements, the newspapers will have readers.

When it comes to news, to informative, educational and opinion-forming matter, the requirements are not so easily met. To get and hold readers in these matters a newspaper must have character. It must inspire confidence. It must be economically independent, therefore, and for this independence adequate support from advertisers and subscribers is a necessity. Of the various forms of financial support, that which most meets the approval of the reader is the support that comes from subscribers. He is a subscriber, and, therefore, he has confidence in the integrity of the source of income. Next in rank is support from the advertisers. By a reasonable exhibition of courage, a newspaper can get its financial support from advertisers without alienating the confidence of its readers.

None of this is possible, however, for the endowed newspaper, the organ of a party or of a movement, the organ of a financial power or of a political candidate, nor is it possible for a propaganda organ. Circulation and advertisements are the only bases of economic independence that are compatible with great influence. They mean readers, and therefore they affect education.

All of this was necessary as a foundation for a discussion of a health column.

ITS EDUCATIONAL ABILITY DEPENDS UPON THE CHARACTER OF THE NEWSPAPER

Independently of the question of the number of readers, much depends upon the character and the type of a newspaper, in determining its educational effectiveness. There are papers in which a health column, for instance, is almost useless. The people who read papers of that type will not read a health column, or, if they read it, they will not be influenced by it. There are other papers in which what is said in the health column exerts great influence. And then, there are papers in between.

THE PAPER ITSELF MUST RESPECT ITS HEALTH COLUMN

Also, to be effective, a health column must have a good position in the paper. The best place by all odds is the editorial page, since readers approach that page in just the right frame of mind.

As illustrating the point: Some health story occasionally makes the front page and the large-type headline. Such a story receives a great deal of attention and causes much comment and discussion. It registers. But front page health stories cannot be indulged in with advantage, except at considerable intervals, without losing their power to capture attention and cause discussion. For one thing, like highly seasoned food in the daily diet, they pall. For another, they excite too much sales resistance. For the daily presentation, and for the development of a following, the editorial page furnishes a better atmosphere.

Considerable depends on the attitude of the paper itself, its news force, its editorial policy, and its management in determining the effectiveness of a health column. It needs occasional watering by notice from other columns. This notice may even be hostile without great loss, provided only the paper always seems to give weight to and respect what is said in the health column.

THE MATERIAL MOST EFFECTIVE

This division of the subject necessitates a statement of the objectives of the health column. The principal objective is favorably to influence the customs and habits of the people. Other important objectives are

to shape opinion, and to make information available. But these objectives cannot be attained unless the column captures and holds interest.

In the education of children, we have learned that didactic presentation of facts is not enough. Interest must be captured by pictures, story or anecdote. In a health column the same principles prevail. The readers' major interest is elsewhere. At least some of the readers, in the pursuit of those major interests, will persistently read any presentation of facts, however presented. But when it comes to minor interests, the matter that is presented like a lecture, a treatise, or a systematic text will not be read. Some thought must be given to the presentation. Illustrations could be used to advantage. It is unfortunate that editors do not appreciate this. Wit and humor are very helpful. Gossip and anecdote, stories of people and things, are of service. If the presentation is orderly, it must not be recognized as such. A planned schematic method of presentation is generally left unread.

THE READER IS BENT ON GAIN

The great, underlying motive of the reader is generally gain. He reads because he hopes to gain something somehow. It is often a desire to gain useful information; it may be opinion; it may be something else. But the writer must bear in mind that the reader of a health column is after gain, albeit the strain of getting it must not be great.

THE VALUE OF THE CONTROVERSIAL

A difficult matter to decide is: How far can the writer go in matters that are controversial? There are shallow, unthinking people who say no controversial matter should ever be touched upon. This is, of course, impossible and unwise. We lose interest in matters that are fixed and determined. All progress comes through flux. When the "being accomplished" changes into the "has been accomplished," then ensues crystallization, and then death and decay. We either go forward or we go backward. Practically all men sense that, though they know not how or why.

And then, who else avoids controversy? Do the courts? Does politics? Does anybody? What are court opinions? The very theory is wrong. It is based on the old sacerdotal idea that opinions must come from above; that the king, the religious potentate, the State, the people must blindly follow. One reason for the unsatisfactory condition of opinion of the people on medical subjects is that the medical profession has always followed the idea of the priestly attitude.

It is neither possible nor advisable to avoid the controversial. Those who claim to do so in presenting health information fail to carry out their claims and weaken their presentation in addition. None of which

should be construed as meaning, however, that there should be no exercise of judgment in the selection of heatedly controversial themes.

THE IMPORTANCE OF WHAT THE READER IS THINKING ABOUT

There has been a tendency in recent years for medical societies to attempt health columns written by members of the society. Many of these efforts have not succeeded. They have certain inherent weaknesses.

Health articles, to be influential, must be signed. Anonymity violates several essentials. Yet they cannot be signed by practising physicians without violation of the code of ethics and, what is more fundamental, violation of certain rules of fair competition. It is impossible to draw the line against advertising and permit practitioners to sign such articles.

As a rule, these medical society articles are written by men who know nothing of the art of presentation, however well they may know medicine. They are generally text-booky. They do not take into consideration what the potential readers are thinking of and are especially interested in. Some machinery for keeping the writer aware of what potential readers are thinking about and what they are interested in is most essential.

THE REMEDY OF INCREASED WISDOM

There are two objections that are urged against a health column with such frequency that they should receive attention. One is that the health column causes people to be introspective as to their physical selves and thus begets subjective diseases, makes so-called neurasthenics and such. As though there had never been gossip about operations, diseases and symptoms and health columns had started something new! The answer is: Neurasthenics and subjective disorders are the creation of mental makeups. They are mental types. To a limited extent, health columns furnish food for these, just as gossip did. To a greater extent, they are correctives. The remedy for shallow draughts that but intoxicate the brain is deeper draughts that sober it again. This has been so since the days of the Pierian spring.

The other is that individuals will apply to themselves statements that, while true as a rule and for the average, are not true as applied to that individual. Again, the answer is that nothing new is created. The tendency, in fact the habit of doing this, is established. It holds true of every rule. The remedy does not lie in abolishing rules, or even generalizations. It lies in increase of wisdom, and that comes by trial and error better than by any other route.

WHAT THE HEALTH READER IS INTERESTED IN

The health column should cover practically all of personal hygiene. It should touch on nearly every phase of habits. As often as possible it must touch on customs. But since the interest of individuals is in the individual and not in the group, customs can be covered only to a limited extent.

The column must cover mental hygiene as well as physical hygiene, both because mental hygiene is a greatly neglected field in medical science and because bad mental habits cause much misery.

It can give some anatomy and some physiology because there is a moderate interest in the machine aside from its work. It must deal considerably with symptoms and somewhat with treatment. That has always been the traditional approach, not only to disease, but to physical welfare, and we cannot break too much or too rapidly with tradition with advantage. We hear much of the advantage of limiting a column to what some call positive health, and the avoidance of what some call negative health. There is a little truth and much clap-trap in this point.

Let any man try to limit himself to so-called positive health daily for three hundred and sixty-five days in a year. He will soon run out of subjects. He will shortly find himself pouring out uninteresting, shopworn thoughts, facts, banalities and platitudes and, what is more important, he will find himself without readers.

It is the even run of the repetitions every day that counts; the dependable presentation that combines interest, dignity and information, and inspires confidence. And these qualities cannot be met under this limitation.

THE PRESENT INTEREST IN GENETICS

Can Race Betterment be presented in a health column? If the word be used broadly, the answer is: Race Betterment is the purpose of the column. Narrowing the meaning: Can genetics be so presented? As a separate column for genetics, I do not think so. Interest is not great enough as yet, even though we contend that there are facts enough.

I should say that this is even true of popular periodicals that specialize in such subjects as motherhood, infant welfare, child care and problems of the home. Genetics can well be presented in such periodicals, in periodic informative articles, preferably signed. But this is not a health column.

In a health column, genetics should be interspersed with other subjects. It should be treated as part of a great theme rather than as a separate theme. And there is ample interest right now in various parts of the genetics theme. I am convinced of this by the several hundred

letters that come to me daily. People are interested in such subjects as: Marriage of relatives; marriage of defectives; size of family; inheritance of mental and physical qualities; inheritance of defects; birthmarks; inheritable diseases and peculiarities; inheritance explanations of qualities and attributes of individuals; longevity; and many other subjects. So far as some of these subjects are concerned, they lend themselves readily to gossip. When genetics questions can be tied into personalities, as they frequently can, the presentation is very apt to go over. For instance, if some genetic fact can be woven into a story about Washington, Lincoln and some historic or popular character, it will be read by and it will register with persons who would never have noticed a more impersonal presentation.

Health columns are established. They are founded on correct psychology and sociology. It is not the time to argue for them or against them. The only profitable discussion is that which relates to methods of making them more serviceable.

There is great need for genetics. The need is not recognized. No state or local health department has a division of genetics. Yet genetics should be an integral part of their work. If you will read Volume I of "The Rise and Fall of Disease in Illinois," you will see how the Illinois Department feels on the subject. They discuss the need, the advantage, and some of the methods of meeting it. Yet they have not started. Some educational force is needed by them as well as by all other health departments.

Newspapers on a self-supporting basis, economically independent, with a large circle of readers whose confidence they enjoy, can be of incalculable help in bringing about the establishment of genetic divisions.

Don't forget them. You must not neglect them.

THE TRAINING OF HANDICAPPED CHILDREN IN THE PUBLIC SCHOOLS OF DETROIT

Dr. Charles Scott Berry, Professor of Educational Psychology, University of Michigan; Director of Special Education, Detroit Public Schools

The significance of differential treatment and training for handicapped school children has not been fully grasped even by those professionally engaged in the work of education. Few have seen the possibilities of corrective treatment and training as a means of reducing in the next generation the size of that vast army of 500,000 criminals, insane, feeble minded and paupers that are now in the prisons, hospitals, institutions and almshouses of the United States. It is only during the period of compulsory school attendance that we have the opportunity of examining all the children of all the people with a view to the discovery and correction of serious defects or incipient tendencies that, if not corrected, mean suffering to the individual and loss to society.

In November, 1927, there were enrolled in the public schools of Detroit 213,000 pupils, exclusive of those pursuing education beyond the twelfth grade. Of this number 10,500, or 5 per cent of the total, were enrolled in special classes or schools for handicapped children. These children are handicapped physically or mentally or both to such an extent that equality of opportunity for them means differential training and instruction. In other words, they deviate from the type to such a degree that they cannot, in justice to themselves or to others, be educated wholly in the regular grades by means of the traditional subject matter and methods of instruction.

Among these more than ten thousand handicapped children are to be found the blind and the partially-sighted, the deaf and hard of hearing, the anemic and the tuberculous, the crippled, the defective in speech, the mentally retarded, the delinquent and the emotionally unstable.

Although these children differ widely in respect to the nature of their handicaps, yet all possess two characteristics in common: First, the fundamental desire to be like their normal fellows and to participate in their activities; and, second, the tendency to develop an inferiority complex. Furthermore, in respect to health and vitality, intelligence and achievement, favorable heredity and desirable home conditions, all types of handicapped children seem to compare unfavorably with the unselected school population.

ATTENTION IS DIRECTED AWAY FROM THE HANDICAP

In the training and instruction of handicapped children in special classes and schools, the immediate aim is to remove the handicap and to return the child to the regular grades, prepared to compete on equal terms with his normal fellows. But where the handicap cannot be removed, the child's attention is directed away from his defect to the development of those possibilities in which he is most nearly like the typical child. One reason so many children leave school at the earliest possible moment is because they are compelled to compete with the typical child in activities for which they have little aptitude.

THE BLIND

In the special classes of Detroit there are 300 blind or partially-sighted children. Since in the case of the blind vision cannot be restored, they are taught Braille, the touch method of reading, and their attention is directed away from their handicap to the development of their greatest possibilities in order that they may be able to mingle on more or less equal terms with their seeing fellows.

But in order for us to be successful in this attempt, it is necessary that the public assume a different attitude toward the blind. The coin tossed to the blind beggar may ease the conscience of the giver, but it only makes the beggar more keenly aware of the difference between himself and others. The blind cannot rise above their handicap as long as those of normal vision treat them as if they were outcasts. As one intelligent blind man expressed it, "You treat bald men as differing from other men only in respect to baldness; then why should you not treat us as differing from other men only in respect to sight? What we crave above everything else is the companionship of our normal fellows."

In order to develop a mutual understanding between blind children and those of normal vision, the former recite in the regular grades with seeing children but report to their special teachers for the necessary individual instruction. And when the blind leave school, every effort is made to place them in positions where they can earn a living and at the same time enjoy the companionship of their seeing fellows.

THE PARTIALLY-SIGHTED

While the people do not understand the blind, they are scarcely aware of the existence of that many times more numerous group, the partially-sighted. In this group are found the children who, although not blind, yet have vision so defective, even after it has been corrected as far as possible by glasses, that they cannot read ordinary print at all or only with injury to their eyesight. The special classes for these

children are known as "sight-saving classes." Children are admitted to these classes only upon the recommendation of the oculist furnished by the Board of Health.

Provided with text-books printed in twenty-four point type, suitable writing materials and typewriters, these children pursue their education without injury to their eyesight. In fact, in many cases there is a marked improvement in vision due to proper medical treatment and to the training and instruction they receive in the proper use of their eyes from the teacher of the special class. Like the blind, they recite in the regular grades with children of normal vision, and receive the necessary individual instruction from their own special teacher.

Although sight-saving classes for the partially-sighted are comparatively new, they have abundantly justified their existence.

THE DEAF AND HARD-OF-HEARING

Over three hundred deaf and hard-of-hearing pupils are receiving special education in the public schools of Detroit. The congenitally deaf and those who lost their hearing during the first three years of life must be taught speech as well as lip-reading. Here, as in the case of the blind, the attempt is made to teach them speech and lip-reading to such an extent that they may be able to live happily and successfully with their fellows of normal hearing. The development of speech in the congenitally deaf requires long years of patient and skilled instruction by specially trained teachers.

While the public has long been aware of the educational work that is being done for the deaf, they have heard little of lip-reading instruction for that much larger group, the hard-of-hearing. These are the children who have become discouraged through constant effort to understand the world that is so near and yet so far. Through lip-reading, sight supplements hearing and the child discovers to his delight that his hearing seems to have improved. Few investments in education are yielding a greater return than instruction in lip-reading.

THE DEFECTIVE IN SPEECH

The four thousand children of defective speech enrolled in the speech-improvement classes of Detroit are taught by thirty specially trained teachers who devote all of their time to the correction of speech. These teachers, although giving each child but two lessons per week, correct more than forty per cent of the defects of speech within a single school year by working in cooperation with the physician, the home and the regular grade teacher. During the school year of 1926-1927, these thirty teachers made more than 1,700 visits to the parents of children defective in speech.

Experience has shown that it is of vital importance that the child of defective speech be given corrective work as soon as possible after entering school. For speech correction means re-education. Faulty habits must be broken down and correct habits built up.

Less than ten per cent of the children enrolled in speech correction classes fail to show improvement within a single school year. Many of these cases require careful study by a speech specialist to insure the desired correction.

When one considers the importance of speech, it seems strange that so little work has been done in many communities to remove a handicap that compels individuals of superior ability and of fine personal qualities to accept inferior stations in life, to suffer constant disappointment and humiliation.

SPECIAL OPEN-WINDOW CLASSES

Of the 1,700 children enrolled in the open-window classes and in the open-air schools of Detroit, 27 per cent are cases exposed to tuberculosis, 40 per cent are cases of underweight and malnutrition and 14 per cent are cardiac cases. These children receive all their instruction from specially trained teachers who work with the nurses and physicians of the Board of Health. These pupils are taught in open-window rooms, furnished an abundance of nourishing food, and given the opportunity for adequate rest. Each child is weighed periodically by the school nurse, and examined as often as necessary by the school physician.

New open-air schools are being built and additional open-window rooms provided for what seems to be an unlimited number of children who need this differential treatment. While much is being accomplished, a still greater work remains to be done, the removal of the causes—ignorance, poverty, disease.

CRIPPLES

More than five hundred children are enrolled in the special schools for cripples. Of this number 60 per cent are victims of infantile paralysis, or tuberculosis of the bones, the two great scourges of childhood. Another 13 per cent are suffering from spastic paralysis, which all too often cripples the mind as well as the body. It is not without significance that only 6 per cent of the five hundred have congenital deformities.

Before the children are admitted to the schools for cripples, they are examined by an orthopedic surgeon furnished by the Board of Health, and they are under his supervision while in school.

Transported by the Board of Education to and from school, taught by specially trained teachers, given plenty of nourishing food, oppor-

tunity for rest, and physiotherapy treatment under expert medical supervision, much is being done for them to minimize their handicaps and to enable them to make the most of their possibilities. Yet the causes that cripple children still remain.

The types of handicapped that we have already considered—the blind, the deaf, the defective in speech, the anemic and tuberculous, and the crippled—if neglected would to a great extent become an economic burden to society. But the remaining groups, the mentally retarded, the delinquent and the emotionally unstable, if not given differential treatment and training, will in a large percentage of cases become not only an economic burden to society but a menace as well.

THE MENTALLY RETARDED

Of the 3,000 pupils enrolled in special classes and schools for the mentally retarded, 65 per cent are boys and 35 per cent girls. Sixty-seven per cent have intelligence quotients between 51 and 70, 28 per cent have above 70 and 5 per cent have intelligence quotients of 50 or less. Up to thirteen years of age the boys and girls are educated together in special classes. Thereafter they are transferred to separate special schools where they follow different courses of study. Only children of inferior intelligence who are failing in the work of the regular grades are admitted to the special class, and no child is allowed to remain in the special class who is found able to do the work of the regular grades.

In the education of the mentally retarded it is essential to bear in mind: first, that their handicap cannot be removed; second, that they closely approach the normal individual in physical traits; and, third, that they must be prepared for those occupations that require the least intelligence. Experience has shown that at least 95 per cent of the pupils in our special classes have sufficient intelligence to succeed in unskilled labor provided they are given the right kind of training. Hence, in their education academic subjects play a minor rôle, with the chief emphasis placed on the formation of right habits, the development of health, strength and skill, and the acquisition of the knowledge that they will need in daily life. The results of such training have exceeded the expectations of the most optimistic, for those who have long been regarded merely as a social menace are being developed into useful citizens. However, this is being done only at a much greater expense and by the expenditure of much greater time and effort than that required to educate an equal number of normal children who possess vastly greater possibilities for happiness and service. The greatest problem still remains unsolved, the discovery and the removal of the causes that make for mental retardation.

DELINQUENTS

In the special classes and schools for delinquents are enrolled more than 300 boys ranging in age from 12 to 16 who were serious behavior problems while in the regular grades. In this group are found the mentally retarded, the emotionally unstable as well as those normal in body and mind. Many of the latter, after a few months spent in the special school, make satisfactory adjustments when sent to a prevocational school or to a regular elementary school other than the one from which they came. The mentally retarded whose behavior has improved after a more or less protracted stay in the school for delinquents are transferred to the special schools for the mentally retarded. It is the emotionally unstable who are most apt to remain in the school for delinquents until they have completed the period of compulsory school attendance. Many of these boys need institutional treatment.

In the schools and classes for delinquents the emphasis is placed on knowledge of the boy, assignment of work within his capacity, with special reference to physical training, manual activities and health education. The result is that most of the delinquent boys find life in the special school more satisfying than it was in the regular grades and consequently cause little trouble. One finds, however, in the classes and schools for delinquents very few boys who have been sent there for stealing, although stealing probably brings more school boys into juvenile court than any other single offense. Evidently the enrollment in the classes and schools for delinquents represents only a very small percentage of the delinquents in the public schools of Detroit who stand in need of special study and treatment.

CHILDREN UNDER TWELVE WITH SERIOUS BEHAVIOR PROBLEMS

While special classes or schools have been established in most large cities for the mentally retarded and for the delinquent of adolescent age, little special treatment or training has ever been attempted for the children under twelve years of age who are more or less serious behavior problems. Last fall three special classes for children of this type were started in the public schools of Detroit. In these classes were enrolled only children of normal intelligence who were serious problems in the regular grades. The emotionally unstable, the young delinquent and the child with personality defects are found in these classes.

It still remains to be seen just how successful special education for this type of child will prove to be. However, judging from what has even already been accomplished by specially trained sympathetic teachers working with the physician and home, differential education for the young child who is a behavior problem has great possibilities.

THE PREVENTABILITY OF THE HANDICAPS

But those engaged in the care and training of the handicapped have an additional duty, that of acquainting the general public with the causes that make for the crippling in mind and body of thousands of children annually. It is of vital importance that the public should know that more than two-thirds of the crippled children are handicapped for life through preventable causes; that half the blind must grope in darkness the remainder of their days because society has not removed the causes that make for blindness; that one-third to one-half of the mentally subnormal are doomed to lead lives of impaired efficiency or to become a burden or menace to society through our failure to wipe out the causes that make for mental retardation. It is well for the people to know these things, for them to realize that it always costs more, and in many cases many times more, to educate the child who is handicapped than it does to educate the typical child, and that even then the efficiency or happiness of the handicapped child rarely equals that of the child normal in body and mind.

NURSERY SCHOOLS NEEDED

Ignorance, disease and poverty are the triple threat to childhood. And the unfortunate thing is that where one appears the other two are likely to be present also. Ignorance and disease that lead to the crippling of little children could be greatly reduced by establishing nursery schools and clinics in connection with the public elementary schools. where every girl during the period of compulsory school attendance could receive proper training and instruction in the care of young children, and where young mothers could come for advice and counsel. And the blighting effects of poverty could be lessened if every girl were taught the household arts in relation to minimum income.

NEEDED ENLIGHTENMENT FOR REDUCING THE NUMBER OF HANDICAPPED

I have a right to the protection of my property against fire, but if I seek protection of my child against malnutrition or disease, assistance is given only in the name of charity. Is the destruction of public or private property more of a social menace than the blighting of human life by disease or poverty? Until the protection of human life is put on at least as high a plane as that of property, the crippling of children through preventable causes will continue.

If all boys and girls were taught during the last year of compulsory school attendance what is definitely known about the inheritance of undesirable traits or tendencies, much might be done to reduce the number of the congenitally handicapped, for no man or woman desires to be the parent of a defective child.

As I have already pointed out elsewhere,[1] we deprecate the increase in the birth rate among the inferior classes and the decrease in birth rate among the upper classes, and raise our hands in despair as to what should be done. The fact is, as every one knows who has given any thought to the matter, that birth control is practised by the middle and upper classes, but that this knowledge, which is current among the more intelligent, is not the common possession of those most inferior in intelligence. Then why not give the mentally retarded instruction in birth control? Why not recognize the fact that the sex instinct and the parental instinct are not the same? The sex instinct may be very strong and still be associated with little or no desire for children.

Does any one suppose that even mentally retarded parents are so deficient in intelligence as to desire a large number of children when they are scarcely able to support themselves? Children are no economic asset, as they were in the earlier history of our country. If so many of the more intelligent and more prosperous members of society voluntarily restrict the size of their families in order that they may properly provide for their children, is it a crime to enlighten those of less intelligence in order that children defective in mind may not be brought into the world? It may be replied that they should control the sex instinct. Possibly, but the fact is that they do not. We are confronted with a condition, not a theory. If free clinics were established where knowledge in regard to birth control might legally be obtained from physicians, the problem of the excessive increase in the number of defective children would in large measure be solved. For then nurses and social workers could direct to these clinics those who stand most in need of this information.

Could anything be more unintelligent than for the intelligent to go on caring for and educating the handicapped without attempting to reduce their number?

1. Charles Scott Berry. "The Case for the Mentally Retarded." Mental Hygiene, Vol. IX, No. 4, October, 1925, pp. 725-734.

MORAL EDUCATION

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Moral education is just education at its best. Goethe has well said, "Only the best is good enough for a child." And Dewey has well said, "What the wisest and best parents desire for their children that must society desire for all children." We go the life route but once, and therefore all education of all persons should be up to that standard of the "best."

Moral education is not a segment like physical, or academic, or vocational, or religious education. It is rather the temper or spirit of the whole procedure that determines whether that procedure contributes or does not contribute to the welfare of the learner as a person and as a member of the historical institutions.

Physical education may be carried on in such a way that it may contribute to health and strength of body and general physical well-being and yet be immoral, leaving the learner not only untrained in sportsmanship and uninterested in public health but positively vicious in sports and unpatriotic towards public welfare.

SCHOLARSHIP VERSUS GOOD MORAL CHARACTER

Academic education may be immoral. It is coming to be one of the scandals of education that men and women achieve what is termed scholarship without achieving good moral character. The correlation between academic training and good conduct seems to be low. Press reporters and cheap fiction writers seem to take delight in describing wrong-doers as high school pupils or college students or teachers or professors. Certain it is that there are many men and women, reputed to be scholars in the academic sense, who are selfish, cynical and unsocial.

In vocational education boys and girls and men and women are achieving what is reputed to be success in training, in craftsmanship or in trades, without achieving the ability and disposition to "live completely," even in the Spencerian sense. Many of the boys and girls from the vocational schools are incapable of the full enjoyment of craftsmanship or good workmanship itself, either as a form of creation or a form of social service. One of the pathetic aspects of all education, but of vocational education in particular, is the increasing disposition to estimate education in terms of quantity and economic returns. Output and economic returns are very important, even essen-

tial, but they are not the only, nor are they the final, form of value from the standpoint of education. Boys and girls are robbed of their rightful inheritance if their work and the returns of their work do not contribute to the whole of life, in short if they are not moral.

Religious education, too, is usually treated as a segment. There are Sunday Schools, and other schools termed religious, that carry on their program in ways termed successful that do not seem to have any profound effect upon conduct and life. Behavior and procedures are tolerated in schools called religious that would not be tolerated in a good public school. "Our permanent crime wave," the current fiction founded upon college life, and the current criticism of education, furnish data for making out a very serious indictment against education. How can these things be? Why is it that in these segments of educational endeavor there may seem to be success and yet the personal or even the total outcome seems to be a dismal, a pathetic failure?

In the last analysis, the present situation comes from failure to recognize and to capitalize the moral nature of humans. Education is both possible and necessary because human nature is essentially moral. In the title, "Moral Education," "education" is substantive, "moral" is attributive, but is descriptive, not definitive, singling out moral education from among other kinds. The alternatives are not moral education or some other kind, but education better or worse in moral outcome. "Better" or "worse" are moral terms. They are the comparative of the superlative "best" and "worst." The term "moral" as an attributive to education is honorific. It means good morals.

CONFUSIONS AND CONTENTIONS CONCERNING MORAL EDUCATION

Many if not most of the confusions and contentions concerning moral or character education come from conflicting theories and practices in both education and morals. There are many grounds for differences in both fields, and when they are treated in attempted isolation or as separate subjects of study, then there is the added difficulty of trying to patch up the unwarranted bifurcation.

It is becoming increasingly clear that any particular theory or practice of moral education must be determined by, or must at least be consistent with, the general theory of education. Stated differently, the general theory of education is concerned with the whole of life in all its aspects. The particular theories and practices of moral education are concerned with how to make education the best it possibly can be. The possibilities and continuing probabilities of continuous confusion and contention arise from the baffling complexity of educational procedure, along with its transcendent importance.

BAFFLING COMPLEXITIES

A child is not only the most important but also the most interesting and most complex thing in the world. The complexity is too evident to need elaboration in this connection. Matching the complexity of the pupil is the equal complexity of the teacher. Then there is the equally baffling complexity of the intercourse, discourse, fellowship, and partnership between pupil and teacher. In addition to these inherent complexities, the means and methods of education are rapidly increasing. The amount of information and knowledge is increasing so rapidly that no one can keep up with it. Then the subjects are differentiating almost as rapidly. The synthesis or integration of information has hardly begun. Some hope lies in a central coherent view of education.

WHAT IS EDUCATION?

For purposes of this paper education is formulated as being *the procedure by which personality and institutional progress are achieved.* This formulation needs some elaboration. The term "procedure" is used because what pupils and teachers and other educators do does not just go on. The process is under some control and management. The educative process is rooted and grounded in nature, but at its best education supervenes upon nature and is rightfully termed nurture. If education were something like digestion or circulation, or even like development on which it depends, then "process" would be the appropriate term. The educative procedure is more like cooking and eating. The educational processes are procedures. Causes are raised into controlled means and the effects are resulting consequences in which purposes are achieved and which exhibit personal skills, knowledge, and attitudes.

The term "personality" is used in the formula because nothing less than this term can express the possibilities that can be actualized through the best educational procedure. The term "personality" stands for the potential and actual integrations of all the abilities and dispositions that may be referred to a particular person.

The term "institutional progress" is used because the historic institutions, the home, organized industry, the church, the state, and the school furnish the environment or situations in which personality is developed and achieved. The ideas of purpose, plan, and program are implied in the term "institution."

Education implies not only development but also progress. In "The Control of Life," the author, J. Arthur Thompson, develops not only a formula but a validation for his formula. His definition is, "Progress is the balanced movement of a social whole towards a fuller embodiment of the supreme values of life." With Thompson the general

terms for the supreme values are "the true," "the beautiful," and "the good." This formulation of progress makes life the interpreting principle.

The term "achieved" is used because the agents of education, the learners and teachers, in raising causes into means assume some responsibilities for consequences, and are accordingly entitled to the satisfactions or annoyances that come from the procedure.

This formulation of education makes human life as we live it here and now furnish the interpreting principles for the theory and practices employed. It has been objected that the term "life" may be used to stand for something just as abstract and undefined as the terms "culture," "discipline," and "scholarship." This objection is not well founded. It is true that we have no acceptable definition of life, but that is just because it is the primary concrete process that all of us experience.

However, if life as we live it here and now is to furnish the principles by which we may discover the laws of life and learning and by them formulate educational procedure, then propositions must be made about life that will suggest ways and means for the realization of formulated objectives.

HABITS AND SKILLS OF PRIMARY IMPORTANCE IN MORAL LIFE

Nurture supervenes upon nature and we must turn to the contributing sciences for primary guidance.

1. *The Biological Formula*—Brooks of Johns Hopkins describes life as "The response to the Order of Nature." The primary characteristic of the "Order of Nature" is *recurrence*. This is true from atoms to stars. The recurrent day, month, and year establish many of the fundamental routine occurrences of human life. This principle along with the plasticity of matter, which no doubt is a corollary of recurrence, furnishes the physical foundation for habits and skills, and these are of primary importance for the moral life, not only in themselves but also in that they afford that surplus so necessary for improvement at higher levels. If we had to think about the routine acts economically carried on by habits, there would be no time or energy left for contemplation and thinking of a higher order. Alternatives, deliberation, choice, and intelligent action depend upon surplus.

THE EVER-RECURRING CONFLICT BETWEEN AGE AND YOUTH

2. The principles of recurrence are most obvious in natural processes below the life level. A second level of fundamental Order of Nature is found in living organisms and is known as development. In one very important sense development is a more complex form of recurrence. Each member of a species repeats the life cycle, but the

life cycle through the span of life is composed of a series of novelties. These series of novelties cause what are called stages of development. These stages make necessary the changes that favor progress. But they also put great strain upon the principles and practices of morality. We have here one of the causes of the eternal and ever-recurring conflicts between youth and age. When and how are the standards and ways of youth to be "put away" and the ways and standards of adulthood to be "put on," to use Paul's apt phrases?

THE MORAL IMPLICATION IN THE DOCTRINE OF EVOLUTION

3. A third aspect of the Order of Nature is expressed in the sweeping generalizations of evolution. In a very important sense evolution is a cosmic process similar to the developmental process in the individual organism. It is a form of selection—natural selection or choice—operating on a universal scale. The fit are said to survive, but the elimination of the unfit is just as significant as survival. The moral implication and the emerging moral problems resulting both from evolution and from the doctrines of evolution have never been adequately recognized in the theory of education.

MORAL ACHIEVEMENT IN SELF-MASTERY

In the human organism the ratio of the new brain to the old brain or spinal cord is fifty to one. The significance of this important fact is just beginning to dawn upon educators. The heredity fiends, as Langdon-Davies calls the extremist in biology, refuse to recognize the implications of the unique neural structure of man. The erect position, the freeing of the hand, and the emergence of language makes it possible for man to make a new environment within certain limits. This is sufficient reason for substituting the term "situation" for environment when considering the order of human nature. The emergence of the human neural system and the accompanying ability termed intelligence presents interactions of agent and situation quite different from the so-called "struggle for existence" employed in the theory of organic evolution. In the volume entitled "Reality," Streeter terms this human procedure "Creative Strife." By this strife man is "overcoming" nature and by this process and procedure is achieving some degree of self-mastery that is a great moral achievement. It is at this level that science is so important.

PRIMARY DATA FOR CONSTRUCTING A SOUND THEORY

Man is in and of Nature a part and is subject to the principles of recurrence constituting Nature. Man's human nature makes it possible to supervene upon the recurrent order and create a new world somewhat after his own image. As Schopenhauer admitted, the works of

man do reflect some dignity upon him. Of all the works of man, the institutions, the family, organized industry, the church, the state, and the school are the greatest. By these perpetual triumph is possible. The Order of Nature changes and the rules of mathematics do not apply when human beings join together for common or institutional purposes. By means of intelligent moral cooperation, two men digging a well may accomplish ten times what one can do. Through cooperation with the eternal, the ethnic religions promise that man may overcome the world. The laws of recurrence, of creative strife and of perpetual triumph furnish primary data for constructing a sound theory of moral education.

The Commission on the Reorganization of Secondary Education appointed by the National Education Association did not use the terms here employed, but they did make this same threefold analysis. They set up seven objectives that are personal or institutional: (1) Health, (2) Command of Fundamentals, (3) Worthy Home Membership, (4) Citizenship, (5) Vocation, (6) Worthy Use of Leisure, and (7) Ethical Character. These objectives are to be achieved by: (1) Habits and Skills, (2) Knowledge and Insight, (3) Attitudes and Ideals.

EVERY EDUCATIONAL PROCEDURE HAS MORAL IMPLICATIONS

The unique and central place of the moral nature of man in relation to education is more forcibly and perhaps more clearly seen in viewing it in relation to the five aspects of human life expressed in the phrases: (1) Physical life, (2) Mental life, (3) Moral life, (4) Spiritual life, and (5) Religious life. It must be remembered that these are but aspects. Life is a whole and an integrating principle. That is why morals are so important. But consciousness, and particularly consciousness when operating as attention, is focal, and, as Childs so well demonstrates, one aspect may be dominant and for a particular event the other aspects are subordinate. If we formulate life in terms of responses, (1) the physical life is the response of the body to the physical order; (2) the mental life is the response of the mind to the logical order, especially of time, space, and cause; (3) *the moral life is the response persons as choosing agents make to the social order;* (4) the spiritual life is the response of the will to an ideal order; (5) the religious life is the total response of the person to the total order, an attempt to systematize one's values. In the best of lives these aspects form a hierarchy and it will be noted that the moral aspect occupies a central position. Not only so, the moral principles afford the principles of value and integration for every concrete situation just as religious principles afford the scheme of values and integration for the totality of life responses. In short every human situation and every

educational procedure has moral implications, and if those implications are not made explicit and operative by being brought out, the learner is robbed of a rightful inheritance.

HOW EDUCATION ACHIEVES MORALITY

I—By Helping the Learner to Achieve Habits and Sentiments of Succeeding

To be moral, education must help the learner acquire habits and sentiments of succeeding, and succeeding so well in some particular responses that they may be termed skills. The enjoyment of the satisfactions of skillful actions is an indispensible ingredient of a moral personality. Every normal or near normal child can succeed in a number of the procedures that are fundamental for the good life. Of course normal persons are less successful in some of life's procedures than others. The curriculum and the program of education to be moral must be plastic to the (a) interests, (b) abilities, and (c) needs of the learner. To be so, three requirements are necessary: First, the wisdom of the teacher so she may know and recognize the interests and aversions, the abilities and disabilities, and needs of the learner; second, freedom and disposition of both learner and teacher to adopt and adapt curriculum, program, and procedure; third, the necessary ways and means for carrying out such procedures.

Partial successes or even dismal failures need not necessarily cause that discouragement that results in personal degeneration. As far as possible failures are to be avoided, but when they do occur, moral education transmutes them into reflective experiences that help the learner escape such failure in the future. Disabilities that cannot be escaped can be borne with that fortitude that becomes a personal achievement. Failures that induce intelligent successful reflection forewarn and forearm against the future.

II—By Developing Knowledge and Insight That Insure Efficiency

To be moral, education must help the learner develop that knowledge and insight that will insure efficiency and fullness of life. It must be remembered that knowledge is implied in habits and skills for recurrent routine situations, but the supreme tests of knowledge and insight are the new moral situations that arise in a developing, evolving world.

Concerning knowledge and insight in relation to moral education, there are a number of confusions, the worst of which is the failure rightly to view the nature and function of knowledge. As educational procedure is now organized and administered, there is no guarantee that habits and knowledge will contribute to welfare, either personal or institutional. There again knowledge is accumulating so rapidly that

educators are lost, particularly in perspective. It is true that any knowledge of any kind might some time in some circumstance prove to be of value, but no one is so foolish as to believe that all knowledge is of equal value, and since life is short only the best is good enough.

The worst superstition concerning knowledge is the common belief that it can be communicated by means of language. This superstition is so ingrained and universal that it seems almost hopeless to dissipate it. It cannot be done by argument or by example. The only possible way to eradicate this wasteful superstition is to begin at birth. There is a single conclusive argument. Words do not communicate knowledge. This is a true statement, and if they did do so this statement would dissipate that superstition, but it does not.

"Knowledge is power" is one of those dangerous half truths. But habits and skills, and knowledge and insight, are instrumental and may be used to multiply power. But both may be used for good or evil, depending upon the purposes of the person. If educators ever develop the theory that the right use of things and facts is an essential part or aspect of the truth about them, and then if they intelligently and seriously apply this theory in practice, there will be a new era in human evolution.

There is no sound defense for spending public money to increase the skill and knowledge of anti-social boys and girls, unless perchance there is no possible way to tell whether a child is or will be anti-social. If it cannot be ascertained, then of course we must take chances and go on educating every child, but it is very foolish and wasteful to continue the present policy of assuming that current education is good. It is high time that the public gave attention to this problem and until it is solved or proved insoluble, it should be as easy to get money and competent researches in the field of morals as it is in agriculture or astronomy. Agriculture and astronomy begin with "a" and are at the head of the list. Morals are down near the middle of the alphabetical list.

III—By Developing Right Attitudes and High Ideals

To be moral in the best sense, education must result in the development and achievement of right attitudes and high ideals on the part of the learner. In the last analysis this is the supreme test of education. Habits and skills and knowledge and insights are instrumental. They may be used for either moral or immoral purposes. We are at the very heart of the problems of moral education when considering attitudes and ideals. Here we are concerned with the affective aspect of life about which we know very little, and seem averse to approaching the problems in the ways the nature of the emotions demands. Human

emotions are little understood. In fact in many quarters, particularly scientific, the emotions are taboo. It seems to be the fashion to avoid even discussing them. They are reputed to interfere with scientific procedure. This is not the time or place to go into this important problem because no immediate solution seems to be in sight. It should be noted, however, that the study of the sentiments gives some promise of a solution if we analyze our environment into (1) Nature, (2) the works of man by which he tries to improve upon Nature, and (3) persons, as individuals and as groups organized into institutions. With this analysis, instead of a bewildering maze of stimuli to emotional responses, there will appear a possible threefold approach.

Until a better is proposed, we may accept McDougal's formula: "The sentiments are the organizations of the emotions about the ideas of objects." In this formula the term "object" must be used in both senses—a thing of observation and also something to be attained and sustained. The sentiment towards one's mother or home or country refers to these as objects and also implies the object to sustain them.

THREE SIGNIFICANT PROBLEMS IN MORAL EDUCATION

Three significant problems in moral education are concerned with the development of right and high sentiments towards Nature, towards work and all the results of work as the art of man, and then the development and education of the whole gamut of sentiments involved in the moral relations between persons as persons and as members of the historic institutions. For the present the schools rely almost entirely upon subjects and subject-matter for education. The pupils have introduced extra-curricular activities and these have great promise for moral education, but the schools do not capitalize the possibilities of the subjects.

THERE ARE MORAL IMPLICATIONS IN THE SUBJECTS—TAKE SPELLING FOR EXAMPLE

A particular unit of subject matter has a worthy place in a curriculum, or a particular event is worthy of a place in an educational program, because of moral implications. That is the power of the material or event to contribute to life at its best.

The severest possible test of this supreme formula is found in its application to the formal subjects. Spelling is one of the most formal of the subjects. There is nothing in Nature or in human nature requiring that words be spelled the way they are spelled, and yet they do their work adequately. Spelling has not been selected for treatment because of its importance but because it affords a severe test of the formula proposed.

It will be recalled that the moral life has been defined as the response a person as a choosing agent makes to the social order. Persons must spell when they communicate with other persons by means of writing. The spelling of words is determined by social usage. The particular spelling of a word is a *mores,* a social custom. The learner and writer must conform to this custom if spelling is to be right. Otherwise it is wrong. Persons who conform in the right spelling of all their words are good spellers. Those who do not are bad spellers. The words, "good," "bad," "right" and "wrong" are moral terms.

All three aspects of education are present in spelling—(1) habits and skills, (2) knowledge and insight, (3) attitudes and ideals:

1. The acquisition of skill in spelling affords the satisfaction that comes from being a *good* speller and from spelling *right*. Conversely the spelling events have in them the implications of the annoyances or remorse that come from being a bad speller and from spelling wrong and receiving the disapproval of teacher and class and self.

2. The second kind of "event" in formal education is concerned with knowledge, as already pointed out. The habit of spelling a word is knowledge also, but there is a higher form involved. In addition to the formal skill of spelling a reasonable number of necessary words right, "with a minimum of time, means, and energy," there must be the knowledge of how to find out how to spell words not yet learned. This is the problem of learning how to use the dictionary efficiently. The dictionary is the authority for the spelling of words and it should be obeyed, and this obedience is an exercise of a moral function. It is the right use of useful knowledge.

3. The third aspect of the modern formula for formal education is concerned with attitudes and ideals. This is the problem of the development of a spelling conscience—the ability and disposition to spell right. The determination not to guess but to find out how to spell a word when in doubt. It is easy to over-emphasize the importance of spelling. It has often been done, but, it is impossible to over-emphasize the importance of doing what in spelling needs to be done the very best it can be done under the circumstances. There is no reason for claiming that the moral results from being a good speller will be generalized and carried over into other aspects of life. The demand for right spelling can stand on its own feet. If the students of psychology who have reopened the question of transfer of training should discover that the good habits of good spelling and the valuable knowledge of how to use the dictionary and a good spelling conscience do carry over into other aspects of behavior, so much the better will be the good teaching of spelling.

There are good reasons for believing, however, that good spelling, and particularly a good spelling conscience, is an integral part of an integral language conscience, because spelling is but an aspect of language experience. This is another moral aspect to this problem of spelling. There are good reasons for believing that, whether there be any transfer from the moral results of spelling to other fields of action or not, the simple experiences of right action and the satisfactions and annoyances involved in spelling furnish cases for comparison, contrast and generalization in reflection about conduct, in this way affording data for the development of one's ethical theories and practice.

THE SAME ANALYSIS MAY BE APPLIED TO ANY OTHER SUBJECT

The same analysis and argument may, of course, be applied to arithmetic, or to any other subject, for that matter. It should be pointed out, however, that though arithmetic is classified as a formal subject and is taught as such, yet it is not so artificial and formal a subject as spelling. Units, addition and subtraction, fractions, and the like are found in the very constitution of things and natural processes.

Some special significance has been ascribed to arithmetic because it is an instrument of commerce and the exchange of property. This is important, but no more so than the importance of spelling as an instrument of social intercourse. These are but aspects of the moral implications of subjects.

The fundamental assumption underlying the present treatment is that every human event carries its own moral implications, and that upon no single subject or group of subjects is placed the burden of producing the moral life. Human events are moral or immoral because they are human. Every educational procedure, curricular or extra-curricular, has its own moral problems involved.

"RECOVERY FROM WRONG DOING" VERSUS "PUNISHMENT"

The worst failure in education in the United States has been the treatment of wrong-doers. Not so much that they have been ill-treated as that they have not been helped to recover from the wrong-doing. Every study that has been made shows that many of the inmates of our penal institutions are in these institutions for the same kind of immoral conduct as that for which they were punished at home and in school. In short, punishment seldom reforms. The root cause of failure is found in the fact that in most punishment we treat symptoms instead of causes. The most striking example of this foolish procedure is found in the way teachers treat "wrongs" in English. Teachers spend hours putting red or blue marks on composition papers thinking that such procedure will cure the error. About all such procedure does is appease the ignorant conscience of the teacher. Wrongs, wrong

English, wrong conduct of any kind, should be righted, but, to be made right, causes, not symptoms, must be treated.

The term "punishment" should be dropped from the vocabulary of education. Not that wrong-doers should go unpunished, far from it. The meaning of this term and the procedures associated with it are so inadequate and inefficient that about the only way to reform procedure is to drop the term in the hope that wrong theory and procedure will disappear. It is herein proposed to substitute "recovery from wrong doing" for the term "punishment." Let it be noted at once that this does not mean soft pedagogy. When persons do wrong, they should suffer all the just consequences of their wrong acts. But from the standpoint of education, the suffering is merely cruelty unless it cures the wrong-doer.

THE RÔLE OF THE WILL IN RECOVERY

From the standpoint of morals, wrong-doing is a matter of the will. This is true even when the wrong act was due to ignorance. The agent did not know how to will the right. The same is true where error arises from carelessness or thoughtlessness.

Since the wrong act is a break in the will, that is where the recovery must occur. It cannot be brought about through the ears by means of scolding or sermonette, or through the hide by corporal punishment.

The wrong-doer must face his act, must acknowledge both the act and the error, and then must reverse the will. He must will with, instead of against, the processes that produce right conduct. This is a social process—a process involving the wrong-doer and the ingenuity and wisdom of a counselor in the person of parent, teacher, or friend. The parable of the prodigal son illustrates both the steps of degradation and the recovery. First he came to himself, faced his conduct, and after contemplating his home, he said: "I will *arise*"—note it was an act of the will—"I will go," "I will say." Note also the functions of the father. The trouble with the older brother is also very significant.

A PLAN OF PROCEDURE TO EFFECT RECOVERY

The process of recovery might be diagrammed in four stages: 1, Repentance; 2, confession; 3, restitution; 4, consecration. In this case the functions of the counselor are first to establish diplomatic relations so that both wrong-doer and counselor understand each other. The second act of the counselor is approval or disapproval of the confession. The third act is forgiveness, if the wrong-doer is willing to be restored to good and regular standing with rightfully constituted authority. After restitution, the fourth step is fellowship, the full guarantee of recovery.

In practice, the best results are secured by having wrong-doers write out the whole plan of procedure. Some such outline as the following can be used:

1. A full account of the case.
2. Effects of the conduct upon self and other.
3. What I propose to do to restore and keep myself in good and regular standing.

MORALITY PAYS

The objector will ask, "What if freedom is an illusion, and morality merely superstition or at best only following a tradition? What about instincts, the subconscious, cause and effect, and the uniformity of natural law?" I am moved to reply in a way similar to a caretaker in England who heard the Bampton Lectures on Christian Evidence. When asked about it, he replied that he had heard twenty of them, but thanked God he was still a Christian. After reading many books on behavior and behaviorism, instincts, the subconscious, and the rest, I still am a believer in the moral life. The wisest and the best men and women believe in morality and try to behave themselves, and further, I believe it pays in the final sense in which behavior ever pays, that is, in the contribution it makes to the abundant life.

This paper has been written making those assumptions. I am well aware that there are persons who do not make those assumptions. There are at present a number of serious, conscientious persons who treat propositions about morals as hypotheses. The problems of morals, yes, the problems of human life, present many difficult dilemmas.

COURAGE ONE OF THE FUNDAMENTAL ELEMENTS OF MORAL LIFE

There are cheap and cowardly ways of facing these difficulties. One way is to follow the impulse of the moment and then try to escape the consequences if they are unpleasant. There are crooked ways of trying to escape the problems of life. The crook changes his own name and the names of things, tries to hide or run away, but as the Good Book says, sooner or later his sins find him out.

Over against these cowardly ways of facing life's problems there is the courageous way. Certainly courage is one of the fundamental elements of the moral life. Failures may prove fatal to a child. A fundamental procedure in moral education is so to temper the tasks that the learner succeeds and learns how it feels to succeed. It will be objected that this cannot always be done. All too true, and therefore there is the other problem in moral education of helping the learner to learn how to recover from wrong-doing. Of all the weaknesses in current education this is perhaps the worst.

CONCLUSION AND SUMMARY

Morals are not something foreign or external to persons to be gotten into them by instruction or "education." Morals are not lessons or subjects to be learned. They are the very substance and structure of human nature. Morals are principles operative in the processes and procedures employed in the exercise and development of personality. At their best they are conducive to the greatest possible institutional progress.

Personality is not only a reservoir of power, it is an integrating creative principle. Over against each person is a world of things, persons and institutions that are also morally constituted. Persons and their institutions are morally developed together. It could not be otherwise, since both are of the same constitution.

Moral Education is the procedure by which the achievement of personality and institutional progress are promoted. Race Betterment means just that. It means, first of all, giving nature a chance to run and be glorified according to the constitution of man and his world. Mother Nature and Father Time can be trusted fully to do their part in favoring the abundant life. Human nature must supervene upon Nature. Human mothers and human fathers must intelligently cooperate in a partnership involving all the forces operative. When education, or legislation, or exhortation, departs from the principles of Nature and human nature, it goes upon the rocks and makes shipwreck. Then degeneration instead of Betterment sets in.

But Betterment is possible, both personal, institutional and racial. The recuperative powers of both Nature and human nature are wonderful and all but unlimited. This great fact is one of the grounds for the ethnic religions, which in the last analysis are man's supreme effort to systematize his values, and if systematized according to their constitution, then man and his world are transfigured together. "Delivered by the spirit, delivered from the vision that is incomplete into the vision that is complete, delivered from the bondage of corruption into the glorious liberty of the children of God."

THE PEOPLE OF THE APPALACHIAN RANGE— A NEGLECTED NATIONAL ASSET

J. A. Stucky, M.D., Oto-Laryngologist St. Joseph's Hospital, Lexington, Ky.

It is time that our nation should know of the vast amount of man power going to waste in these isolated districts. The people pocketed in the Appalachian Range of mountains in Kentucky, Tennessee, and the Carolinas are the nation's greatest and most neglected asset. More than two million people are mountain-locked in the picturesque Blue Ridge, Cumberland and Alleghenies. They are the only remnant in this country of the aristocracy of the Anglo-Saxons who pioneered in America. Stalwart, fearless, hospitable and with wonderfully able minds, they have not progressed because of their isolation. The possibilities in their education and the fostering of their latent talents is tremendous. The average American citizen knows little of these real Americans, because his mind runs to business, romance and foreign missions, unmindful and neglectful of these blood relatives and next-door neighbors. These people, "Masters of the Mountains," respond quickly to educational and social opportunities.

Though my first visits to them were in the interest of science—and I saw much to interest and startle me—I found, besides disease, deformities and malnutrition, a people of the purest blood of the nation dormant, as it were, merely eking out an existence as best they could from the natural resources of the mountains and valleys. They were primitive in every respect—in their mode of living, in their home life, in their customs, speech and thought.

THEIR LOCATION

The Appalachian Range extends along the Atlantic Coast from the Gulf of St. Lawrence to the Gulf of Mexico, 650 miles long, about 200 miles wide and has been happily named Appalachia. Along the eastern edge are the Blue Ridge Mountains, running in a northeasterly direction, with the Cumberlands and Alleghenies on the west, and it is in this territory that we find a race of people shut away from modern day civilization because of inaccessibility, a race of people that have never been changed by the infusion of foreign strains of blood that are today proving a problem in other parts of our country.

THEY ARE PURE-BLOODED, ONE-HUNDRED PER CENT AMERICANS

These are the pure-blooded, one hundred per cent Anglo-Saxon Americans who established this great country of ours of which we are so justly proud. They are a peculiar people, in that since coming to

this country they have been shut away from outside influences for these two hundred years and have retained their original customs, resourcefulness and independence. In a day's journey in this region one can be taken back into the Shakespearean period. While these are a primitive people, they are not ignorant, though they are unlettered because they have had no schools. But it was from such ancestors as these that George Washington, Patrick Henry and Abraham Lincoln descended. They have physical defects because they must live on what can be raised in their section. They have little milk, butter and other foods that science today is finding so necessary to the building of normal bodies. For this reason, in this section, we find bone diseases, joint deformity, bad teeth, ear and sinus trouble, trachoma and visual defects with premature age, conditions largely the result of malnutrition.

HOUSES ARE BUILT OF LOGS

The living conditions cannot fully be realized until actually seen. Most of the families consist of father, mother, and from seven to fifteen children, who live in one- or two-room cabins, with lean-to kitchens, often no windows in the house because these houses are built of logs, just as our first settlers in this country built theirs. Their lamps are homemade or candle dip, furniture homemade, and clothing homespun.

THEIR SCHOOLS ARE IMPROVING

In the past twenty years the State Board of Health and the United States Public Health Service have done a far-reaching, constructive work in the eradication of hook-worm, typhoid fever, diphtheria, smallpox, etc., and we now have a few small hospitals scattered through this section, with an average of about one nurse for every thousand of population. Trachoma has been arrested but not eradicated. A splendid work is being done now by the Kentucky Mothers and Babies Committee with headquarters at Hyden, in Leslie County. And, with better roads, we have improved and more modern and better-equipped schools under state and county supervision, as well as several class "A" church schools and settlement schools (interdenominational). As a result, remarkable improvement has been made in living conditions and general health.

GRADUATE NURSES ACT AS OBSTETRICIANS

The work being done by the Kentucky Mothers and Babies Committee deserves special attention, as it is pursuing a course destined to solve a great part of the problem of health and efficiency of these mountain-locked folk. In this county there are no licensed physicians, but connected with this Mothers and Babies Committee are four graduate nurses who have received a two-year training at the London Hospital School of Obstetrics and received diplomas as efficient obstetri-

cians. In abnormal or complicated cases of delivery, requiring surgical aid, the danger is recognized in time to get the woman to a surgeon. Besides the nurse obstetricians, we have several graduate nurses, who stay with the recent deliveries as long as necessary and make regular visits until mother and child are safely on the road to recovery. There are three other stations for the work, several miles distant from the central station at Hyden.

TRACHOMA BECOMING RARE

The Kentucky State Board of Health has done and is doing good, constructive work, and has been able to arrest the progress of disease and to improve living conditions. I quote from a letter received by me from State Secretary A. T. McCormick since I came to this meeting:

"Largely as the result of the trachoma work that you initiated, with the support of hook-worm work, and also with the aid of the Rockefeller Foundation (the whole thing stimulated by the acute condition following the recent flood), we have been able to develop thirty-four All-Time Health Departments in Kentucky. Most of these are in the section most acutely ravaged by trachoma and hook-worm disease. We are able to report that now trachoma has become as rare as it was formerly universal in the sections worst affected.

"Altogether, the representatives of the United States Public Health Service, our Bureau for the Conservation of Vision and the progressive ophthalmologists of the state have operated on between forty and forty-five thousand cases of trachoma. As nearly as we are able to estimate, thirty-five per cent of the cases have been treated by the ophthalmologists of their choice. Of course, you have done the major part of it, and credit for the whole development is due you. The Irvine-McDowell Hospital, with a capacity of thirty beds, has been filled since its opening and has always had a large waiting list. We feel that with a few more years of intensive work and with the fine development of roads in the mountains, also with the aid of the agricultural and home economic agents who are helping to diversify their food supply, we shall practically eradicate the disease in its endemic centers.

HOOK-WORM DISEASE REDUCED NINETY PER CENT IN SOME COUNTIES

"In 1912 we had completed the microscopic examinations of specimens from about 5,000 people in the state for the intestinal parasite. We found hook-worm disease and ascaris infestation prevalent in about one-third of them. Recent re-surveys by the Rockefeller Foundation

indicated that this had been reduced about 90 per cent in the counties having All-Time Health Departments, and about 50 per cent in the other counties that had anywhere in the neighborhood of an adequate medical service.

TYPHOID RATE REDUCED TO ONE-TENTH IN SPITE OF THE FLOOD

"It is also of interest that in the mountain counties that were ravaged by the floods in May and June, we were able, through practically universal inoculation, to reduce the typhoid rate to about one-tenth of that of any preceding year."

This report is certainly most encouraging, and is the result of much hard and persistent scientific work.

A PROGRAM OF EDUCATION

A knowledge of biological, physiological and sociological life with facilities for living such a life. This is a three-stage procedure:

(1) *Pre-Natal Care.* This is given as nearly as possible according to standardized methods, approved and used by leading obstetricians including not only careful observation of the expectant mother but regulation of her diet and living conditions.

(2) *Post-Natal Care.* By this I mean supervision of both mother and child for several months after parturition, and the diet of the child regulated until weaned. It has been demonstrated that gestation tests the integrity of every tissue of the body, frequently resulting in imbalance of the secretions of the endocrine glands with resulting disturbed neurotic, psychic, and metabolic function.

(3) *Early Childhood to Adolescence.* It is during this period that the foundation of a physical well-being is laid, and if a biological, physiological and sociological life is lived, we shall have less disease and deformity, stronger bones, teeth and muscles, and a more stable nervous system, because of a body more capable of resisting invasions of bacteriological and cocci diseases.

THESE MOUNTAIN PEOPLE A RESERVOIR OF THE FINEST MATERIAL

President Theodore Roosevelt said, "A real American is one who believes in and stands for the things America stands for."

President Woodrow Wilson declared, "It is my belief that the two millions of people living in this mountain region have been preserved there to supply a great future need in American life." This seems prophetic in that this reservoir holds the very finest material to be found. These mountain people are capable of wrestling with the world,

just as their forefathers wrestled with the world and secured for us our independence as a nation. They are not weaklings, for their lives have been one continuous struggle for existence. Their wits have been sharpened on a natural whetstone, and when armed with education they will prove their ability as real Americans.

THE COMMERCIAL ADVERTISEMENT AS AN EDUCATIONAL INFLUENCE

HARVEY W. WILEY, M.D., Director Bureau of Foods, Sanitation and Health, Good Housekeeping Magazine

I have been assigned the discussion of the above subject. The field is so wide that I can cover only a small part of it. I shall confine myself, therefore, to the efforts that are being made to keep advertising free of fraud and deception.

Anyone who has paid even slight attention to advertising in the last twenty years must have noticed a very distinct change in this branch of publicity. In the old days the man who made the product also composed the advertisement. He knew exactly what he had, the ingredients that his product contained, and more or less the real value thereof. It required a man of low-down morality to misrepresent the article that he offered for sale.

Little by little advertising became a distinct branch of industry. The advertisements that we read today, at least the greater part of them, are composed by experts. I mean by experts, those who have studied the art of expression with a view to conveying the message in the most attractive and seductive form. It is a well known fact that all the great newspapers, and especially the magazines, weekly and monthly, if they depended on the money obtained by subscriptions, would be sadly in need of aid. Advertising today is by far a greater benefit to the manufacturer than it is to the consumer, and it is better by far for the proprietors of the newspapers and magazines than it is for either of the other parties interested.

TRUTHFUL ADVERTISING

It has been my good fortune now for more than twenty years to have had relations with publishers who desire to print only truthful advertising. When the Council on Pharmacy and Chemistry of the American Medical Association was organized in the early 90's, I was made a member thereof, and I remained a member until my retirement from the Bureau of Chemistry in 1912. My services covered a period of about nine years. I was particularly assigned to the duty of scrutinizing advertisements of infant's and invalid's foods and other foods recommended for medical purposes. This gave me an insight into the efforts that were constantly being made to magnify the virtues of so-called infant's foods and to minimize any deficiencies therein. I had, fortunately, one guide on which I could form my judgment, namely, that the food intended for an infant by Nature was the best food that

could be obtained. This cardinal principle having been established, it was easy to judge of the merits of the advertised foods by ascertaining in just how far they differed from Nature's product. The conclusion was that no synthetic infant's food that differed radically in its character from mother's milk was suitable for an infant deprived of its mother's breast. The corollary of this proposition was evident, that synthetic food prepared for an infant should resemble as closely as possible mother's milk. This led to the rather drastic conclusion that only modified cow's or goat's milk was the ideal substitute for mother's milk.

After my separation from the public service and my resignation as a member of the Council on Pharmacy and Chemistry, I entered the service of *Good Housekeeping*. A part of my duties in connection with my relation to *Good Housekeeping* was to censor all advertisements of foods and toilet articles offered for advertising therein. This gave me a much wider field of activity, and put me in more intimate contact with modern advertising.

RESTRICTIONS ON FRAUDULENT ADVERTISING

There are certain legal restrictions placed around advertisements of all kinds. I am speaking now only of national, not of state restrictions. These restrictions consist in part of denying the use of the mails for fraudulent advertising purposes. The enforcement of this very salutary law is entrusted to the officials of the Post Office Department. The Food and Drugs Act also contains a very wise provision in regard to misbranding, and in Section 8 the following language occurs:

> "The term 'misbranded' shall be applied to any food or to any articles which enter into the composition of foods, the package or label of which shall bear any statement, design or device regarding such article or the ingredients or substance contained therein which shall be false or misleading in any particular, and to any food or drug product which is falsely branded as to the state, territory or country in which it is manufactured or produced."

This is a broad mandate. If applied as it was intended, it would include practically all false representations on the label or in the advertisement as well as all misleading statements. The courts, however, have construed this law in this way, that unless the advertisement accompanies the food package, it does not come under the restrictions of this provision; if the package of food carries also the advertisement, then it is subject to this restriction.

Although limited in its application, the activities of the Food and Drug Administration have done a fine work in maintaining at least

a semblance of truth on the label and in the printed matter carried by the package of foods entering into interstate commerce. The Supreme Court very unexpectedly considered the law in regard to drugs as follows:

FALSE THERAPEUTIC CLAIMS

That false representations mentioned in the statute are only those respecting the composition of the drug, and do not include false therapeutic claims. This decision of the Court practically nullified the law as respects nostrums or secret remedies. In no case do nostrums or secret remedies give their formula, and hence all the claims made for their therapeutic value were, under this decision, valid; at least, they were not to be attacked under the Food and Drug Act. Congress immediately amended the law in regard to drugs in such a way as to include false claims for therapeutic value, and thus remedied the action of the Supreme Court, which practically nullified the law in all respects when it was applied to secret remedies or nostrums.

Under the Post Office Department fine work has been accomplished in denying the use of the mails to fraudulent and misleading therapeutic articles. The efficiency of the service has been largely due to the collaboration with the post office of Dr. Lyman F. Kebler, former Chief of the Drug Laboratory of the Bureau of Chemistry. He is still employed by the new Bureau of Chemistry and Soils, but devotes his whole time to collaboration with the Post Office Department in seeking to restrict the use of the mails for lying and deceptive literature respecting articles in general.

DIFFICULTIES IN RESTRICTING FRAUDS

If an object, which has been excluded from the mails on account of fraudulent practices—that is from the local post office, where business was done—should be sent from any other post office without change of name or proprietorship, the fraud order would be extended to that additional post office. If, however, the name of the proprietor be changed and the name of the fraudulent article be changed at the same time, a fraud order would not apply. Generally the publicity arising from the issuance of a fraud order spreads abroad so rapidly as to make it unprofitable to attempt to carry on the business under the same name. However, by changing the name of the article or the business, another profitable industry can be established with the same article that has formerly been forbidden the use of the mails but is now selling under a new name or under other auspices.

In order to make this provision of the law effective, Congress should provide that the exclusion from the mails by fraud order would apply to all post offices of the country. Of course, any such effort would

be bitterly opposed in Congress by vested interests, and would be difficult of enactment.

Under the Food and Drugs Act, the procedure is quite different There are two kinds of offenses provided for by this Act. One is a criminal offense in which the proprietor or distributor of the article is brought before the bar of justice on a criminal indictment. The other method of procedure is known as the procedure *in rem;* in other words, it consists in seizing the article in question entering or having entered interstate commerce, and bringing it before the court for condemnation. This is a most effective proceeding against one item, but, unfortunately, it does not apply to any other item than the one seized. When these cases come to trial, it is sometimes very difficult to get a verdict under the criminal procedure. Such a verdict, of course, would practically destroy the business in which the criminal was engaged.

If, however, you proceed against the article itself that has been seized, there are two ways in which the law permits the proceedings to be carried on. One is where the article is condemned and ordered to be destroyed. The other is when the article has been condemned but may be removed from the jurisdiction of the court on the payment of a fine or by giving a bond not to offer it again for sale under the jurisdiction of the court. In each of these cases the penalty is trifling. If a bond is given, the article seized is returned to the proprietor to do as he sees fit, provided he does not again offer it for sale. The fine is usually a very small one and can be paid without any trouble whatever and the business thereafter can go on unless other articles are seized. The efficacy of the law, of course, in this respect would depend upon the attitude of the enforcers thereof. They could order seizure of all articles of the same kind wherever found in the country and thus effectually break up the business. In point of fact, such a proceeding never has been enforced, and the result is that the loss of a single item of seized goods is so trifling that the business may be transacted continuously without very much fear of interference by the administration authorities.

There is another procedure that is very common, one in which the claimant of the article seized never appears at all. In a case of this kind, the court pronounces its judgment against the article and orders it destroyed. A very large percentage of the seized articles are disposed of in this way. Of course, the claimants feel that they have no possible show of winning the case and, therefore, simply let it go. Effective activities in this direction are possible to the enforcing officer.

So threatening is this condition of affairs that during the last Congress a bill was introduced the effect of which, if it had been adopted,

would be to restrict the enforcing officers to one item only, and forbid them to seize a larger number. Under the present law there is no limit to the number that can be seized, provided they are of the same kind as the article itself against which the indictment is found. As an illustration of what is being done in this line, I may cite a few Notices of Judgment. The first illustration is of the kind mentioned above.

A SPECIFIC CASE OF MISBRANDING

On November 26, 1924, eight and three-fourth dozen bottles of a drug known as Hesperian Tonic were seized in Utah. This medicine had been shipped into Utah from California. Misbranding of this article was alleged in the libel because it was advertised for the relief of inflammation, hoarseness, diphtheria, bronchial and laryngeal troubles, and eruptive conditions of the skin. These claims were pronounced false and fraudulent. On investigation by the Bureau of Chemistry, the medicine was found to contain no ingredients or combination of ingredients capable of producing the effects claimed. The case was called on June 24, 1925. No claimant having appeared for the property, decrees of the Court were entered adjudging the product to be misbranded, and ordering its destruction by the United States Marshal. (Notice of Judgment 13994.)

AN EXAMPLE OF SHORT WEIGHT

In Notice of Judgment 13995, the seizure was a sample of butter, the property of the Magnolia Dairy Products Co., Houston, Texas. This butter had been transported from the State of Texas into the State of Louisiana, and in pound boxes marked, "Contents One Pound Net." Examined by the Bureau of Chemistry, it was shown that the average net weight of twenty samples was 15.2 ounces. Misbranding was alleged by reason of short weight. On November 5, 1925, the case was tried, the jury having been waived by the parties in the case. After submission of the evidence and argument by Counsel, the court entered a judgment of guilty against the defendants and imposed a fine of $10 and costs. The above, of course, is a criminal case, and the fine was so low as to have no effect whatever in deterring the manufacturers from repeating this offense *ad libitum*.

THE ATTITUDE OF THE COURTS

I may say that, in many cases, fines are imposed as low as $1.00, whereas the law permits a fine of $200 for the first offense and $300 for the second offense, and also imprisonment not to exceed one year.

To show the attitude of various courts, I may say that another case of misbranding and adulterating butter (Notice of Judgment 13997) was on a plea of guilty and was disposed of by a fine of $50 and

costs. On still another adulteration and misbranding of butter (Notice of Judgment 13998), on entering a plea of guilty a fine was imposed of the limit for the first offense of $200. In general, however, the fines are far below the maximum limits fixed by law. I can only recall one case in which the guilty party was imprisoned.

On the whole, the courts have not risen to the occasion and placed maximum limits when convictions have been obtained either through trial or by confession. If the courts had done this, the effectiveness of the Food and Drugs Act would have been immensely increased.

From the foregoing statements you will see that one kind of advertising at least cannot be considered educational. Real advertising is educational in this respect that it makes a worthy product known to the consumer. It thus brings to the notice of millions of consumers what perhaps they never would learn except by slow infiltration from those who use the worthy article.

There is one additional function of ethical advertising, however, that has already been hinted at but that perhaps needs a more definite statement. It is perfectly evident that the tremendous amount of good literature that is found in ethical newspapers and magazines could not have the wide distribution it now enjoys without the aid of ethical advertising.

The problem that is most important to this meeting is whether or not, upon the whole, advertising does more harm than good. If this body of workers for human welfare would take a definite stand in regard to the character of advertising, they would contribute something worth while to the advancement of humanity. There should be a concerted movement, which I am sure will be joined by ethical newspapers and magazines, to repress that form of advertising that harms and even threatens the health and life of people who read it. If we could eliminate all advertising of medicinal remedies, implying as it does a diagnosis made by the patient himself and a treatment without the control of a competent physician, it would be a service to humanity that it is well worth trying to give.

ADVERTISING UNETHICAL THAT EXPLOITS FEAR OF DISEASE

I have not access to the actual money cost of these nostrums, but I judge by the business done in them by successful pharmacists that the total amount of money spent for them would be represented by more, perhaps, than six figures per year. Even worthy products, and one particularly to which my attention has been called within a short time, namely oranges, are advertised by an article on acidosis that cannot fail to impress many readers with the fear that they are suffering from this disease. I consider that kind of advertising of a worthy

product unethical and inexcusable. Thus, even advertising that is intended to be genuine becomes misleading and deceptive.

I am familiar with the claims that advertising does not add anything to the burden of the consumer of a financial nature; that by selling enormous quantities of the article advertised, the advertisement can be paid for and no additional burden laid upon the consumer. This is a fallacious argument. It is quite like that of the high protectionist, who claims that a protective tariff, although it does add to the cost of the article, upon the whole benefits the consumer by having the money he pays for his products spent at home.

My final conviction is, after twenty years of active participation in censoring advertising, that much is yet to be done.

PHYSICAL EDUCATION

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The present research work in physiology and allied sciences has made possible the development of modern physical education. Dr. Harris, former United States Commissioner of Education, wrote as early as 1891:[1]

> "Our civilization is so bent on the conquest of Nature and the production of wealth that it perpetually strains its supply of nervous energy and produces disaster. Here is the special problem of our time for hygiene to meet, how to restore and to conserve nervous energy. There are three factors here: (1) The one of food and its proper assimilation; (2) the factor of sleep and rest; (3) the factor of exercise, muscular and mental."

Modern physical education administratively promotes medical service for the removal of defects interfering with health, and periodic examinations for the detection and treatment of disease. Physical education in addition emphasizes in its program the importance of maintaining and of improving health, (a) through functional examinations, determining nutritional ability, neural stability, cardiovascular power, respiratory capacity, postural efficiency and normal muscular strength and skill; (b) through environmental examination, and promotion of healthful homes, schools, business and public conditions of living; (c) through health instruction; (d) through activities designed to secure health, recreational joy and all-round functional ability.

In his book, "Health Building and Life Extension," Dr. Eugene L. Fisk points out that the economic loss in this country annually from preventable disease and death is over $3,000,000,000; that 42,000,000 people lose 350,000,000 days from illness, disability, and non-industrial accidents. This means that each person on the average loses over eight days of work per year, due to illness. Twenty-eight thousand die annually from industrial accidents. It is probable that a considerable number of these accidents are due to fatigue and to a lack of physical education skills. Of the 25,000,000 people in the working classes who have defective vision requiring correction, some are undoubtedly related to these accidents. Dr. Fisk believes that at least half of this illness is preventable or postponable through proper medical examination, health education, and community hygiene.

The relations between work, overwork, play and recreation, are among the big problems our civilization must solve or die. The health

1. U. S. Commissioner of Education Report, 1891-1892, Vol. 1, page 22.

of the nation depends upon a proper balance of the forces that govern the activities and environment of the individual. At the bottom of the economic question concerning the number of looms in a cotton mill that a man can run in one day, or a series of days, is the biological question of the physiological unit of work for that individual.

I. *Changed Conditions and Attitude Toward the Body.*

Until recently man's fight with Nature, beasts and men, together with the home environment, secured his bodily efficiency. The throwing of the javelin, the use of the sword, the man on the horse—all of these represented activities where eye and big muscles were thoroughly coordinated, not only mechanically but emotionally. The work of women in the home presented the same relationship of the big muscles to the neuromuscular system. Children were taught, not in school, but in the home, farm and workshop, with their parents, to know by doing; that is, there was big muscle work coordinated with mental and emotional activity.

MUSCLES HAVE GIVEN WAY TO MACHINES

The modern industrial system has eliminated largely this big muscle activity. It has taken the work out of the home and put it in the factory, and thus has changed muscle activity to machine activity. The telegraph, the telephone, the radio, and the newspaper, have still further reduced muscular activity, and increased materially the nerve stimuli coming to the individual. The congestion of population in centers has increased the mental and emotional stimuli coming to the individual. Congestion means increased social contacts. These increased contacts mean greater social and neural strain. Dr. R. W. Corwin, Chairman of the Health Committee of the American Medical Association, said in a report to the National Education Association,[2] "Insanity is increasing twice as fast as the population."

THE NEW CIVILIZATION HAS BROUGHT INCREASED NERVE STRAIN

Increased nervous instability is due in part (1) to the failure of bodily adjustment to the environment of the new civilization; (2) to the saving of weaker ones who under earlier conditions died in infancy; (3) and to the greater strain of modern conditions. The nervous system is placed under a greater strain in modern conditions than formerly. Greater tact is required in social relationships. John Erskine, in an article on "Tact" in the December number of *Century,* tells of a conversation between Edmund Waller, the poet, and his doctor. Waller said, "I am cold; even in a warm room I am chilled." The doctor said, "You mean you are old; your blood won't run any more; you are going to die." No modern doctor would retain his practice under such tactless treatment.

2. See U. S. Commissioner of Education Report, 1913, pp. 418-420.

HOW PERSONAL HABITS HAVE CHANGED

Personal habits have changed greatly. One illustration will suffice. There is a great deal of discussion in the papers on the failure of Prohibition. My camp in Maine is located on a farm, where Longfellow helped to raise the barn. The old gentleman who was alive when I bought the place told me that it took more than a barrel of rum to raise that barn, with Longfellow's help. He also told me that at the time the minister preached his first sermon and called on his parishioners, at the close of his call he was often not in shape to get home alone because he was too drunk. The diary of an alumnus of a New England college between 1876 and 1880 shows the condition at that later date. This alumnus speaks repeatedly of the drunkenness at that college. The comparison of the drinking habits even as late as 1880 with the present practice leaves no question of the large improvement that has occurred during the last forty years.

II. *Brief Historical Review of Chief Physical Training Forms.*

1. Grecian: At first this represented simply the Grecian games best known under the Olympic games. The main purpose at this time was to afford sports as pastimes. Later, about the time of Pericles, physical education was used in its best sense to prepare the youths for living. Later it degenerated into professional athletics.

2. The Medieval or Knightly Physical Education: Exercise during this period was used to develop the young page and squire in their chivalric tournaments and jousts. The knights of Italy, France, Germany, England and Scandinavia were devoted in feudal times to these sports.

3. The English developed their sports.

4. The Germans developed what we know as distinctly gymnastics.

5. The Swedish or Ling system: Free exercises in relation to bodily mechanics were developed by the Swedish system. They were particularly strong in the development of corrective gymnastics.

PREPARATION FOR WAR VERSUS PREPARATION FOR LIVING

6. Modern physical education: The new physical education is built upon modern physiology. The earlier types of physical education had as a background the preparation for war. The present physical education has as its objective preparation of the individual for living under conditions of peace and modern industry.[3]

FROM "MORTIFICATION" OF THE BODY TO GYMNASIA

The asceticism of the early Christian church interfered with the development of physical education and of rational ideas concerning the

3. See report on "Physical Training," Dr. E. M. Hartwell, U. S. Bureau of Education, Washington, Government Printing Office, 1899, pages 514-515.

body. They believed in the inate depravity of human nature. They subdued the rebellious flesh through torture and deprivation. Mortification of the body became a religious exercise. Pleasure was directly associated with vice.

In spite of this tendency, the early leaders in American life were favorable to bodily exercise. Noah Webster, the founder of Webster's Dictionary, in an address at Hartford in January, 1790, said, "It should be the business of young persons to assist Nature and strengthen the growing frame by athletic exercises."

Dr. Rush, in one of his published essays, dated August, 1790, proposes that the amusement of our youths shall consist of such exercises as will be most subservient to their future employment in life. He favored agricultural and mechanical employment as a means of diversion and training. He speaks with approval of the Methodist College in Maryland where a large lot was divided among the scholars and premiums given to those who raised the most vegetables. He adds, however, that the Methodists have wisely banished every species of play from their college. President Washington in 1790 transmitted to the first Senate of the United States an elaborate scheme of physical education, prepared by General Knox, at that time Secretary of War. A certificate of military proficiency was proposed as a prerequisite of the right to vote. This recommendation did not pass. The Military Academy at West Point, however, founded in 1817, made an attempt there, from 1817 to date, to connect mental improvement with bodily exercises. The Round Hill School established in 1823, in Northampton, Mass., and the New York High School founded in 1825, both introduced physical education as a part of the curriculum. Harvard College opened its first gymnasium in one of the dining halls in March, 1826. The Boston Gymnasium was opened October 3, 1826, with Dr. Follen as its principal instructor. He was also instructor in German and gymnastics at Harvard College. Amherst College organized its first physical education department due to the report of President Stearns in 1854, in which he emphasized the need of bodily efficiency. His annual report in 1855 to the trustees says, "No one thing has demanded more of my anxious attention than the health of the students. The waning of the physical energies in the midway of the college course is almost the rule rather than the exception among us, and cases of complete breaking down are painfully numerous." Amherst physical education was organized August 6, 1860.

III. *Modern Physical Education.*

The older forms of physical education were built upon tradition and the objective needs of the ruling classes, either for entertainment or for the soldiers for use in war. The modern physical education is

built upon present objective needs guided by the newer scientific discoveries. Men's muscles formerly did the work of the world. Machinery now does that work. The time of labor has been reduced from 14 to 16 hours down to 8 hours or less. Modern machinery makes it possible to supply the needs of the world in about half the working day that was formerly needed. Education and economic need must now be supplemented by education for leisure time needs.

DOES SCHOOL ENVIRONMENT INTERFERE WITH GROWTH AND HEALTH?

There are many striking contributions to physical education from the research field. Only a few of these contributions can be cited in the time alloted to this address:

The studies of growth of St. Louis children by Porter, those of the Boston School Children by Bowditch, the Wood-Baldwin growth tables, and the insurance tables, all show the relationship between growth and health. These earlier tables were all faulty in that they used the generalizing method of statistical study. This generalizing method tends to cover up some of the real facts. For example, if you have 1,000 boys, 500 of whom have gained ten pounds, the other 500 having lost ten pounds, by the generalizing method the average would show no gain. Porter's later study of the height and weight of Boston school children, a study that was begun in 1909 and completed in 1919, uses individualizing methods. His data do not show the seasonal variations in the height of school children, but do show definite weight variations during the different seasons of the year. The monthly increases in weight in pounds are as follows: January, +0.18; February, +0.47; March, +0.22; April, —0.16; May, +0.05; June, +0.74; July, +0.74; August, +0.74; September, +0.96; October, +0.61; November, +0.63; December, +0.98. No measurements were taken during June, July and August, so the 0.74 in each of those months is the division of the total data by 3. The striking thing is the small gain in weight from January to May, inclusive, and so large a gain during June, July, August and September, and again in December. Are these gains due to climatic changes, or are they due to school life? It is possible the December gain is due to the vacation period and to a large consumption of sweets.

We need to know whether or not school life is interfering with the development of the children. A comparison should be made between the country day school, the public school, and the private secondary school. The above data were taken from the public school. Is the environment of the school interfering with the health and growth of the children during the winter season?

WE MUST CONSIDER "TYPES" IN ESTIMATING OVER- AND UNDER-WEIGHT

The Wood-Baldwin tables, the Wood tables, and the insurance tables are faulty in two particulars: (1) They are built upon the generalizing method rather than on the individualizing method; (2) they compare height with weight only. Clinical experience has shown that there are at least three types, the tall slender type, the average type, and the short stocky type. These tables do not adequately differentiate between these types. For example, a boy 5 feet 8 inches tall may weigh 130, 140, or 150 pounds. Is the 130-pound boy underweight, and the 150-pound boy overweight? The tables would suggest that they are. Miles and Root present a thesis that it is unfair to compare height with weight unless body width and depth are also considered. An examination of Hasting's anthropometric tables shows that boys of the same height, 5 feet 8 inches, varied approximately 1 inch in chest width and depth for the same height. These boys were all 18 years of age. Miles and Root assert that body widths are a better index for correlation of weight than is body height. It seems clear that our tables should be revised to include in the tabulations body widths and depths in addition to height and weight. According to the present table, the Swedes are often underweight and the South Italian boys overweight, simply because they belong to different types. These types should be shown in the tables, rather than merely making clinical generalization.

In cooperation with the Springfield public schools, Y. M. C. A. College is conducting research on the growth of boys and girls. This has been in progress for six years, under the leadership of George B. Affleck and Franklin J. Gray. We hope to point out how the boys and girls grow in more definite ways than are at present possible. Gray states[4] that American-born boys of American-born parents are today taller than boys fifty years ago by more than two inches. Do these figures represent growth of private school boys merely, or is it true for the public schools? Much additional work needs to be done on this topic.

HAVE WE FOUND A NEW METHOD OF MEASURING MATURITY?

The methods of measuring organic functions have come largely during the last twenty-five years, much of it during the last fifteen years. A few illustrations will show the scope and relationship of this work to physical education. Seham's study of the systolic blood pressure of children points out that the pressure is 6 to 14 millimeters of Hg. higher in the horizontal than in the standing position. Schneider's study of 2,000 aviators points out that in general the standing blood pressure of young aviators is 4 to 10 mm. Hg. higher than the horizontal position, just the opposite of the children. My

4. See Journal American Medical Association, March 19, 1927, page 908.

study of adolescent boys at Clark University shows that some of the boys are like the children and some of them like the young adults. These three studies were put together for the first time last summer. Have we found a new method of measuring maturity?

The child we know clinically is unfitted for endurance work until the heart has increased considerably in size. This increase in size occurs during young adult life. What types and grades of athletics and physical activity should be allowed to the young child before the change in blood pressure between the horizontal and standing positions occurs?

Meylan of Columbia points out that the heart rate should not increase more than 20 beats on changing from the horizontal to the standing position, and that athletes do not ordinarily have more than 4 to 6 beats increase on changing to the standing position. My study of Joie Ray in Madison Square Garden the night he equaled the mile record of 4.12, attempting to beat Nurmi's record, showed his horizontal systolic pressure as 130, his standing pressure as 100. Another individual, following mountain climbing in Carolina, could not stand up long enough to have his pressure taken in the standing position. I followed his pressure from 120 in the horizontal position down to 60-70 in the standing position four different times. Each time he began to feel faint as soon as the pressure went below 70. Turner points out[5] the reason for this difficulty. Comparing good subjects with poor subjects, she found that the horizontal heart rate with good subjects was 61, and the poor subjects, 70. On changing from the horizontal to the standing position, there was a 10 per cent loss in the minute volume on quiet standing, as compared with the horizontal position in the good subjects; in the poor subjects, 40 per cent. The general averages show the circulation minute volume output from the heart as decreasing from the reclining position with 6.26 liters to 4.77 liters on quiet standing.

These pressure changes and cardiac output volume changes show why women sometimes faint on standing for fitting a dress, or why West Point cadets faint when being held too long at attention. To maintain the pressure in the standing position, and the cardiac output, is difficult, without the breathing aids and the muscle contraction aids of every deep breath. The pressure above the diaphragm is negative; the pressure below the diaphragm is positive. In other words, you have a suction pump above the diaphragm during inspiration and a pressure pump below the diaphragm during inspiration. In addition to this, the muscle contractions force the blood towards the heart. Return to the legs is prevented by the valves in the veins of the legs.

5. In the American Journal of Physiology for July, 1927.

POSTURE IS RELATED TO MUSCLE STRENGTH AND LENGTH

Correct posture depends upon knowledge of good posture, on ability to take it, and on sufficient strength of the muscles to maintain it. Much time has been wasted because of failure in the past to recognize that good posture is not secured merely by knowledge, and by sufficient skill to take the posture. The muscles on the back of the neck, for example, should be short. The muscles on the front of the neck should be longer than they ordinarily are. The muscles on the front of the abdomen are ordinarily longer than they should be, and allow the tipping of the pelvis forward. These should be strengthened in the short position. The muscles of the feet are ordinarily longer than they ought to be, allowing pronation or flat foot. The development of strength of muscles with the right length must be added to the present instructional methods. The following exercises illustrate the methods: Head hold, that is, supporting the body by the head and the heels; arm hold, that is supporting the body by the arms, with the body leaning backward; leg hold, ability to hold the legs at half lever.

TEST YOUR EYE, EAR, MUSCLE- AND JOINT-SENSE OF JUDGMENT

All skills, of running, jumping, throwing, catching and batting, depend upon three physiological elements: (1) Eye judgment; (2) inner ear judgment; (3) muscle- and joint-sense of judgment. These neuro-muscular skills were formerly learned as a part of the occupation of the youth. The development of machinery has largely eliminated hand work. Skills that were formerly learned on the farm, and in other ways, must now be taught as a part of the school program. All of the team games depend for success upon ability based on these three elements of eye judgment, ear judgment, and muscle-sense judgment.

Let me illustrate in an elementary way these judgments. I will ask the audience to stand. First, put one foot directly in front of the other and parallel to it. Stand for 15 seconds. Second, close the eyes and hold the same position for 15 seconds, thus eliminating the eye judgments. Third, stand on the toes, with the eyes open. Fourth, stand on the toes with the eyes closed. Fifth stand on one foot with the eyes open. Sixth, stand on one foot with the eyes closed. Seventh, jump backward with the swinging of the left leg backward, maintaining the balance on the foot without movement of the standing foot.

All skills in golf, baseball, tennis and other sports are dependent upon stance. Stance goes back to these elementary judgments. The Motor Ability Committee of the American Physical Education Association has worked out a series of neuro-muscular skill tests, beginning with the third grade and going up through the sophomore year in college.

SKILLS SHOULD BE DEVELOPED AMONG THE RANK AND FILE

The assumption that boys and girls have these skills natively is wrong. I recently visited a junior high school and saw a group of boys playing playground ball, which uses a large ball and is easier to play than baseball. A third of the boys in this school could not catch or bat or throw the ball well enough to make the game interesting. These skills can and should be taught to all the boys. It might be better if no varsity competition were allowed until the average boy had learned the minimum of skill. The present method of varsity sports takes the best boys and spends most of the time in still further developing their skills. These varsity games have certain great social values. They should, however, contribute more largely to the development of the rank and file of the boys and girls. It might be better in college, for example, to allow no competition in the freshmen or sophomore years, except intramural games, leaving the varsity competition for the junior and senior years as an elective.

EDUCATION FOR A LIFE OF USEFULNESS AND JOY

IV. *Growth of the Modern Program of Physical Education in the United States.*

1. Teachers preparing to teach physical education.
   (a) 1914, 1,848 pupils; (b) 1921, 4,880 pupils; (c) 1927, 12,000 pupils (estimated).
2. Institutions preparing teachers of physical education.[6]
   (a) 1914, 23 institutions; (b) 1921, 81; (c) 1927, 168.
3. States with compulsory physical education in their public schools.
   (a) 1914, 3, none of them actively promoting it, but on the statute books; (b) 1921, 25 additional states; (c) 1927, 7 additional states. At present the thirty-five states with compulsory physical education in the public schools have required physical education for more than four-fifths of the school population in the United States.
4. Membership and subscribers to the American Physical Education Association. This continuation education group indicates also the growth of physical education in the United States:

Year	Members	Subscribers	Total
1885	34	-----	34
1895	131	-----	131
1905	880	143	1023
1915	1036	331	1367
1927	2377	949	3326

The next step is a more thorough development of the content of the curriculum. We must arrange a program so that the children come

6. A revised list received from the United States Bureau of Education, July, 1928, increases the total from 168 to 293.

out of the public school system in better physical condition than they enter it. We must fit them for a life of usefulness and a life of joy. The essential contributions are a better knowledge and application of the matter of structural growth. This is related to nutrition, environment and exercise. We need to measure the organic capacities of individuals, and to temper their activity to their capacity. We need to develop sufficient postural strength to keep the body in proper alignment. We ought at least to devote as much care and thought to this topic as to the proper alignment of our automobile. We should educate the neuro-muscular mechanism in relation to objective skills and subjective feeling judgments. The present complex civilization requires better bodies and better adjusted central nervous systems. Physical education has one of the parts to play in this new complex adjustment.

WHAT PHYSICAL EDUCATION SHOULD CONTRIBUTE TO RACE BETTERMENT

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A Race Betterment program must include two important groups of interests and activities: The one, *euthenics,* is concerned with human life as we find it today. It includes all interests and activities that have for their objective the general improvement of mankind as it now is and lives. It includes, therefore, public health in its broadest sense, education, social and economic welfare, and so on. It is concern for the nurture of humanity; for man's functions and environment, action and reaction to his cosmosphere and sociosphere; for environmental forces that foster or retard the best development of the "inheritance pattern" (the genotype or idiotype) and that determine to a great extent the "secondary pattern" (the paratypic traits) of the realized individual (the phenotype). The other, *eugenics,* which is fundamental and therefore is more important than the first in the long run, is concern for the conservation and propagation of desirable germ plasm (or idioplasm). It is concern for the nature of mankind; for the inheritance material or pattern to be passed on; for "the improvement of the race through intelligent attention to breeding."

Samuel Butler remarked that, "The hen is the egg's way of producing a new egg." Likewise the phenotype (the realized individual), racially speaking, is the gamete's way of producing a new zygote. All who are interested in a real and far-reaching program of race hygiene must accustom themselves to differentiate between the *idea* of the inheritance pattern (idiotype or genotype), which is transmissible, and that of the secondary or "accessory pattern" (paratype), which is not known to be transmissible to succeeding generations.

Euthenics and eugenics call for widely different forms of interest and activities. Yet both are essential, and must supplement each other in a constructive race hygiene program.

THE TREND OF SO-CALLED PHYSICAL EDUCATION

Bearing this in mind we may turn for a moment to "physical education." Physical training can be said to have been the first attempt at a race hygiene movement, as Race Betterment was understood at *that* time. This will not permit even a summary of the interest in physical training in ancient Greece and Rome. Cicero suggests the attitude of his time in his statement that, "It is exercise alone that supports the spirits and keeps the mind in vigor." At the beginning of

the last century, it was Father Jahn in Germany, when Napoleon had Prussia by the throat, who initiated a system of physical exercise—heavy gymnastics, with a view to making the youth of the land strong and vigorous, largely for military purposes. About the same time, Pere Ling and his son Hjalmer devised another system of lighter physical exercise for Sweden. These two systems, later on, were introduced into our country and formed the models of our earlier work in physical training or physical "culture," later termed "physical education."

Let me remind you here that these systems of physical exercise were instituted before we had the sciences that now make up modern hygiene and preventive medicine. During the time of Jahn and Ling, as in the early days of Greece and Rome, systematic exercise was generally regarded as practically the only factor or approach to building up *positive* health and physical efficiency. It, therefore, constituted the general direct euthenics program of the time.

For several reasons, physical education did not maintain, for long, its leadership in the hygiene movement. One of the reasons for this was the fact that innate in the human being there is a very powerful urge (psychologists of a few years ago would have called it an instinct) for physical performance, technique, physical emulation, physical skill, competition, rivalry and mastery. The trend of so-called physical education in the United States in particular was from the idea of exercise for *health*, and from the more or less formal system introduced from Europe to informal activities such as play, games, sport and athletics. Today, one may well say that activities for the sake of activities and contests that permit us to indulge or gratify these fundamental innate interests in physical competition, rivalry, and mastery, either through direct participation or by representation, dominate, in the largest measure, our system of physical education.

THE MANY FACTORS INVOLVED IN DEVELOPING THE BODY-MACHINE

In the meantime, due to the development of those sciences that make up modern medicine, hygiene, and public health, we have learned that while exercise suited to one's needs is recognized as, and no doubt is, an important health factor, there are *many* factors that must be given due consideration in order to attain and maintain a sound, vigorous and harmoniously developed body-machine. We know that the balanced diet, avoidance of body poisons—particularly focal and other bacterial infections—the prevention and correction of physical defects, the prevention of emotional instability, and so on, are of greater importance in a program concerned with normal growth and development and with positive health and physical efficiency than is daily exercise.

The recognition of these other direct health factors has been responsible for other movements and agencies that are concerned with man's physical well-being. Among these are modern medicine and public health, including maternity, infant, child, school, industrial and community hygiene. Naturally this work, for the most part, must be directed and carried on by those who are particularly trained to do it; i. e., physicians, dentists, public health administrators, public health nurses, and other trained workers in the field of public health. Thus we find that the original so-called physical education, with its emphasis on exercise, although an early *positive* health measure, has been supplemented by other agencies that are concerned in a more comprehensive way with health promotion and disease prevention and control.

EUTHENIC MEASURES

Let us now consider briefly some of the interests for *positive* health to which intelligent attention must be given, euthenic measures, in a Race Betterment program. These can be considered in two general groups:

(1) Interests and activities concerned with normal growth and development, with attaining and maintaining a long-lasting, energy-generating body-machine of the first magnitude. Health promotion, personal hygiene, and physiological hygiene are among the terms that have been applied to this group. It includes concern for the following health factors: Air—ventilation, in relation to motility, temperature, humidity, pollution and pressure; Water; Food—balanced diet, carbohydrates, vitamins, minerals; Sunshine; Exercise; Rest and avoidance of overfatigue; Shelter—clothing and housing; Mental hygiene—the prevention of emotional instability; Avoidance of body poisons both chemical and bacterial, with particular reference to focal infections; Prevention and correction of defects; Prevention of degenerative diseases and cancer; Sex physiology and hygiene; Periodic health examination and overhauling.

It is readily seen that the health promotion group of interests and activities is almost wholly a personal matter. Health promotion must come, in a large measure, through a system of effective education that should begin with the pre-school child. Each child, through a system of graded lessons, should be helped to appreciate the various factors involved in building and maintaining a sound body-machine and positive health. Lasting health habits should be formed. Furthermore, the child should be led to appreciate the importance of intelligent attention to health in good citizenship. In other words, we must engender in the child the right attitude towards health. The recent health education movement, the latest health movement to appear on the horizon, has this for its objective.

(2) The other group of interests and activities, essential in effective public health work, is that concerned with the prevention and control of communicable diseases. A sound, vigorous and harmoniously developed body-machine does not prevent one from contracting infectious diseases. For example, ingestion of virulent typhoid bacilli on the part of the most vigorous as well as on the part of the weaklings will result in typhoid fever.

The prevention and control of communicable diseases are, in a large measure, community problems. Fortunately we can set up machineries and employ experts to look after, for the most part, this phase of public health work, with the cooperation of those concerned. A program for the prevention and control of communicable diseases calls for an understanding of the nature of infection and of the sources of communicable disease; for determining the routes over which communicable diseases travel; and applying specific and general measures for blocking these routes.

Public health work, as a direct euthenic measure, then, consists of these two groups of interests and activities: Health promotion and communicable disease prevention and control. Of course, the relative values of the various factors or approaches referred to in the health promotion group change with the various age periods of the individual and with his occupation. Likewise, a program for the prevention and control of communicable diseases is very much influenced by the age group with which one is dealing and with geographical distribution.

EUGENIC MEASURES

So far, in public health work, little has been done from an eugenics standpoint. The more or less ultra biologist, in fact, holds that a direct euthenics program of health promotion and disease prevention and control has little if anything to do with a constructive and far-reaching program of *race* hygiene and that it is *dysgenic*, since through it many subnormals who ought to be eliminated are preserved and, therefore, permitted to propagate their kind. I have little sympathy with this point of view. In dealing with children in particular, we have little means yet of differentiating between idiotype and paratype, between nature and nurture, unless we are dealing with extremes or are familiar with the genealogic tree. We are all extremely complex heterozygotes, conditioned by innumerable and varied paratypic as well as idiotypic traits.

Intelligent attention to nature and nurture must be correlates, not alternates. The developing organism is the product of both nature and nurture. I cannot believe we are ready yet to accept such statements as, "The influence of environment is not one-fifth of heredity and quite

possibly one-tenth of it." As Barker states it, "Whatever phenotype the zygote develops into, as embryo, fetus, infant, child, adolescent or adult, must depend obviously upon the composition of the gametes that fuse to form the zygote—the genotype; and second, upon the influences (chemical, physical, psychical) outside the zygote that act upon it to form eventually the phenotype or realized individual."

EXAMPLES OF "TRANSFORMATION" BY EUTHENICS

I have observed upon a number of occasions the work with subnormals in schools where it is the custom to cull out those who are below par in height, weight and mental reactions, in many qualities, in fact, desirable in the normal boy and girl. I have seen these culls brought together in special schools under specially trained teachers. "A sad lot, indeed," is one's impression of them at the opening of school. The ultra biologist would be constrained to feel that perhaps the wisest procedure, as far as Race Betterment is concerned, is to take this little group of marasmic weaklings and remove them from this worldly sphere of action; and this may be true in certain cases, inhumane as that would seem. However, I have seen this same group, on the whole, transformed. This transformation often includes body, mind, and morals, in fact everything that makes up the personality of the child.

Various surveys indicate that about 18 out of every 100 children in the first five grades in the public schools, where such surveys have been made, were what was termed "backward"; that what may be termed faulty nurture (lack of intelligent attention to faulty teeth, tonsils, vision, hearing, nutrition, etc.; adenoids; bad home conditions and bad habits, etc.) seemed, in some measure at least, to lie back of the backwardness in about 15 of the 18. In the other 3 (2 to 3 per cent of those examined) the backwardness was, however, apparently due to conditions for which little if anything could be done, the mistake having been that the parents of these children had been permitted to have children, and probably their parents before them.

The result of these surveys emphasize (1) the importance of euthenic measures, including early thorough medical inspection of children of pre-school and school age followed by intelligent attention to the correction of correctible conditions that are real or potential handicaps, and also (2) the fundamental importance of intelligent attention to eugenics, for, as Dr. M. F. Guyer states in the preface to his excellent book, "Being Well Born": "We must see clearly, furthermore, that even the best pedagogy and parental training has obvious limits. Once grasp the truth that a child's fate in life is frequently decided long before birth, and that no amount of food or hospital service or

culture or tears will ever wholly make good the deficiencies of bad 'blood,' or in the language of the biologist, of faulty germ plasm, and the conviction must surely be brought home to the intelligent members of society that one thing of superlative importance in life is the making of a wise choice of a marriage mate on the one hand, and the prevention of parenthood to the obviously unfit on the other."

A SOUND HEALTH PROGRAM IS MANKIND'S ATTEMPT AT ADJUSTMENT TO ENVIRONMENT

Where some genotypic weaklings may be spared in an effective public health program, many children are salvaged who are subnormal because of faulty nurture not nature and who have a right to and ought to live. Some weeds are always spared even in the cultivation of the best crops. Also the various approaches to health promotion are important even for those with excellent germ plasm.

Again, as has been suggested, those inheriting the highest type of innate possibilities are as susceptible to those communicable diseases that have played important rôles in the morbidity and mortality of humanity as are those whose germ plasm is not desirable for propagation. We are by no means agreed as to whether it was the dying out of the best germ plasm or whether it was the introduction of the hemotobium of malaria that was responsible for the deterioration of the ancient Greek civilization. Consider the regeneration of the South as a result of hookworm extermination. No nation made up of citizens of the very best germ plasm can remain for long in the vanguard of civilization in this complex machine age, this age of rapid environmental change, unless it is actively concerned with a sound euthenics program including comprehensive public health work.

After all, the various interests and activities included in a sound health program are nothing more or less than the attempts of mankind to adjust itself to important particular aspects of its environment. Is not this the basis of evolution and progression? We know that orders and species of animals have become extinct because they failed to make this adjustment. We must help those who are born to develop the best that is in them and to make the best adjustment possible to their environments. However, intelligent eugenic measures should go hand in hand with or precede euthenic measures.

Many present, especially those who are teaching physical education or are preparing to do so—to whom this paper is especially addressed —may wish to remind me that the subject of this paper was supposed to be what "physical education" should contribute to Race Betterment. I hope, however, that you have seen that most of what I have said bears more or less directly or indirectly on this.

Physical education if taken in a literal sense would mean a very much bigger subject than is the range of interests and activities commonly called "physical education"—that is why I speak at times of "so-called" physical education. As we have seen, what is commonly called physical education controlled in the past and still controls for the most part only *one* of many health factors, and other agencies have supplemented the physical education program in most schools.

STUDIES OF THE INFLUENCE OF EXERCISE ON HEALTH

As to the contributions of physical exercise, there is still comparatively little scientific information regarding the influence of exercise on health. Its possible contribution, if properly understood and used in corrective measures for certain posture, feet, and musculature defects or weaknesses and for certain functional irregularity, is recognized. Also, the reactions called forth by vigorous muscular activity are being studied by a number of physiologists. Increased lung activity in relation to exercise has received attention, and the fact has been brought out that if the activity is prolonged a perceptible increase may be noted in the hydrogen ion concentration of the blood, and lactic acid may appear in the urine. The increase in heart and circulation rate and in the oxygen-carrying power of the blood, in relation to exercise, have also been studied. That exercise increases the leucocytes or white cells in the blood is claimed, but this may be redistribution instead of increase. And so on. A report by Barcroft and Stephens[1] of striking variations in the size and color of the spleen in relation to rest and exercise, apparently through a nervous control rather than a humoral pathway, will stimulate further study along this line.

Certainly what we know of growth and development, from an euthenic standpoint, strongly indicates hygienic values in exercise if suited to individual needs, especially when taken out-of-doors. Also those who take regular exercise suited to their needs usually testify to its benefits, but opinions are not scientific data. Those who teach "physical education," as well, proclaim its health value along with other values, but relatively few who are teaching or supervising it have had the scientific training that would make it possible for them to make a scientific study of this and related problems.

PHYSICAL EDUCATION MUST BE CORRELATED WITH A COMPREHENSIVE HEALTH PROGRAM

Again, in this machine age what was looked upon as normal physical activity in connection with normal life in earlier generations is greatly reduced in amount and more limited in range, both in the home and in most lines of work. This has come about through the wide substitution

[1]Journal Physiology, 64: 1, '27.

of apartments or smaller homes for larger ones, the use of the telephone and of various labor-saving devices and machines; piece-work methods in factories, etc. Even the leisure hours of many are spent for the most part not in activity but merely in "stepping on the gas." For this reason, encouraging the development of the habit—a habit that should not stop with school days—of devoting some time to physical activity, of one sort or another suited to one's interests and needs, has become, probably, increasingly important. A program of "physical education" should include a varied sports program adaptable to the various seasons—one that is interesting, enjoyable and habit-making and that can be modified to fit adult needs later on as well as present needs of students.

As has been suggested, in many schools now there is a department of "physical education" emphasizing exercise, recreation and competitive sports; and other agencies, doctors, nurses, etc., who form the "health service." Physical education is interested in student health, but in most cases those concerned with its program are trained to emphasize only one of many direct health factors along with interests and objectives only indirectly or remotely related to health and outside the direct interest of the health service staff, namely: The Greek ideal of body form; neuro-muscular control—precision, muscular pliability, agility, dexterity, skill; performance—physical capacity, strength, endurance; recreation; and certain "mental, moral and social by-products" claimed. Also, as has been said, the health interest is easily lost sight of in interest in and enthusiasm for skill, performance and competition.

The staff of the health service, on the other hand, must give scientific attention to many matters concerning student health that are outside the domain of the general staff of "physical education"; which cannot be handled by a physical educator unless he or she is a well trained physician as well. Scientific information, regarding the value —from an euthenics standpoint at least—of the health factors included in the field of the health service staff, is not lacking. Take, for example, the periodic health examination followed by corrective measures if the need is indicated. The habit of intelligent attention to (not over-concern for) health including periodic health examinations should be established early in life. Our schools and colleges should foster this, not only for student health and academic efficiency but as it will bear on health and service to society in later years as well. Also the prevention and control of communicable diseases and provision for the treatment and care of ill students lie in the field of the health service.

Though each has objectives outside the domain of the other, both physical education and the health service have a common interest in

the health of the student. His physical examination and health record are of interest to both. The program of each depends largely on these records. A health program like any other program loses in effectiveness if its parts are not correlated. In some schools an effort has been made, therefore, to correlate all direct student health interests into a comprehensive health program.

The term "physical education" still means, to many, health education. That is why some thirty-four or more state legislatures passed laws making the teaching of health and physical education compulsory in the public schools of those states. Lack of adequately prepared supervisors and teachers for such work, however, has usually limited the results of such programs.

An important point I want to emphasize is that if those who supervise and teach "physical education" in our schools have not adequate scientific training, and if the work in "physical education" is not correlated with a comprehensive health education and health promotion program, so-called "physical education" will serve as little more than a recreational program for some and a special physical-skill producing process for others, in connection with which popular and colorful events are held. Some things will be over-emphasized and others neglected. Its limitations and its possibilities will not be appreciated.

NEEDED SCIENTIFIC TRAINING OF PHYSICAL EDUCATORS

To cooperate, as many of the more broadly trained physical educators are doing and desire to do, in an effective, comprehensive health education and health betterment program, those who supervise it and those who teach it need adequate scientific training. They do not need to be chemists, physicists, biologists, anatomists, physiologists, psychologists, etc., but they do need to have a sound working knowledge of the normal vital processes; they need to have had thorough general courses, at least in chemistry, physics, biology, anatomy, physiology, psychology, hygiene, etc. They need adequate scientific background to appreciate the possibilities and the limitations of their work and its relation to the health problem as a whole. They need to know when and how to cooperate with, and when and how to seek the cooperation of, other health agencies concerned with individual and race hygiene. Lack of training and vision hampers results. When those who have had adequate scientific training in preparation for their work wish to do more advanced study, many interesting lines that bear directly or indirectly on their field will be open to them.

Society itself must be helped to an appreciation of the importance of *intelligent* attention not only to euthenics but to eugenics. Practical and effective measures for real Race Betterment can be provided in a

Democracy in no other way. Thorough general courses in biology and race hygiene, as well as in individual hygiene and public health, should be taken by all college students. Adult education, also, should include articles and lectures along these lines.

Certainly *all* who have any part whatever in efforts at human betterment, even though their special work may lie in euthenics, in order to appreciate the possibilities and the limitations of their own work and their part in the program as a whole, should be informed regarding the well established facts in genetics and eugenics. They should have some understanding of the structure, mechanism of reduction, maturation and fertilization of the gamete whereby the zygote is formed. They should appreciate what is meant by such terms as homozygote and heterozygote, variation, mutation, inheritance pattern, acquired characteristics and modifications. Mendel's numerical laws of inheritance, dominant and recessive characteristics, their presence in the heterozygote state as a mosaic rather than a blend or fusion, and the genetic methods for separating them, should be so familiar to all interested in race hygiene that they would find as much mental recreation in working out hypothetical pure stock free from taint or in formulating imaginative improved stock as some find in working out cross-word puzzles.

All interested in individual and Race Betterment should appreciate the fact that the findings of our biologists show that an individual passes on his inheritance pattern; that it is only here and there that paratypic characteristics, under some special circumstances—in certain experiments and some clinical instances—are passed on to offspring and may persist for a time but disappear again sooner or later; that while environment may contain also influences that can alter the germ plasm itself (idiokinetic influences), these are still little understood and so bear little, at the present time at least, on a race hygiene program. Studies on the effects of temperature on the pigment-producing capacities of B. Prodigiosus; the work of McDougal with the primrose; the results of Tower's experiments on the potato beetle; Guyer's research with lens; the contributions of Bardeen, Little, Mueller, and others relative to the alteration of germ plasm by means of the X-ray; the work of many other geneticists along the lines of experimental paraphoria; and the apparent idiokinetic effects of syphilis, alcohol, and lead poisoning, should be of great interest to all interested in Human and Race Betterment.

All should appreciate the possibilities of:

(1) Elimination hygiene: The diminution of fertility among those below average capacity; restriction of undesirable germ plasm through

education and legislation; a more discriminating public opinion and laws relative to marriage; control of immigration; segregation of the unfit; and the more drastic measure of sterilization. (2) Elective race hygiene: Conservation of desirable germ plasm; increase of fertility among those above average capacity through education; creating and fostering race consciousness whereby larger families will be forthcoming on the part of those bearing high grade germ plasm; enlarging individual opportunities; preventing germinal waste resulting from wars, hazardous occupations, etc.; subsidizing the fit.

In any program for *Race* Betterment, of course, it must ever be borne in mind that the "value of an individual as such is not necessarily his value as a progenitor;" that paratypic qualities are conditioned and transcient. Dr. Guyer points out also that, "Eugenics is mainly concerned with the relative rates of increase of the various classes, not with mere fertility in itself. And the actual increase must be measured in terms of extent to which birth-rate exceeds death-rate."

IN SUMMARY

Summing up what I have attempted to say:

Race Betterment is dependent on intelligent attention to both euthenics and eugenics.

"Physical education," with its special concern for physical *exercise* —an early euthenic measure—is now supplemented by, should cooperate with, and seek the cooperation of, other agencies concerned with *many* important health factors.

At present there is comparatively little scientific information regarding the influence of exercise on health or longevity or regarding what "physical education," if taken to mean the range of interests and activities commonly called "physical education," should contribute to Human Betterment or Race Betterment.

I have tried to emphasize the fact that a working knowledge of normal vital processes is essential for *all* health workers; that in order to appreciate the possibilities and the limitations of any special interest or group of interests in health promotion and disease prevention, there must be an intelligent appreciation of the problem as a whole and of the relation the special group of interests has to the general problem; that supervisors and teachers of "physical education" need, therefore, adequate scientific background through thorough general courses, at least in chemistry, physics, biology, anatomy, physiology, hygiene, etc.; and that graduate study along certain lines will open up interesting subjects for study in connection with their work.

To repeat, we still have much to learn about both euthenics and eugenics, but there is great need for widespread appreciation of and *intelligent* application of sound, well established findings.

MAN BUILDING

FIELDING H. YOST, Professor of Physical Education, University of Michigan.

Race Betterment! Search the dictionary from A to Z and you will find no other two words that can be combined to express a more worthy objective. To Better the Race means to give the world healthier, happier and more useful citizens.

Consciously or unconsciously, we seem to have adopted the idea that Race Betterment means the building of a race of supermen and superwomen. It is possible, I suppose, to form a colony of men and women of great intellectual and physical powers and, by directed inbreeding, develop in time a group of mental and physical giants. Possibly, also, after a great many hundreds of years, we may do the same thing on a vastly larger scale with nations and races and, thereby, produce the Arcadian super race.

But is this what we want? Can you imagine a nation composed solely of brain workers? Who would mine the coal, dig the ditches, sweep the streets and perform the physical labor necessary to actual human life?

It is my belief that our task is far simpler, in a way, than this. The philosopher who said that happiness, built on service, is the true realization of mankind's destiny I believe spoke the truth. A man may be useful, happy and healthy without being a superman. I could cite hundreds of examples all about us.

Our goal should not be the development of finer human material alone, but a more intelligent application of the raw material with which we now have to deal to the things that go to make life worth while. A hundred horsepower turbine is not necessary to drive an electric fan, yet an electric fan is a useful thing.

We need bird dogs as well as fox hounds. We need clerks as well as captains of industry. We need laborers as well as college professors in this complex thing we call human life.

In its vital substance, Race Betterment means providing the world with men and women who can enrich it and enrich themselves during their span of life, and thus advance civilization.

THE TRINITY OF HEALTH, USEFULNESS AND HAPPINESS

The truest philosophy of life is so simple that we overlook it in trying to build a more complex structure for human behavior. In the building of men, we have a three-sided goal of progressive development,

the Trinity of Health, Usefulness and Happiness. I know of men who enjoy indifferently good health; men who are useful in the sense of providing for their families; men who are happy, too, to a limited degree. But I maintain that the fullest life can be lived only after we teach men to realize and experience that degree of health that comes from overflowing vitality; to be so alive that their usefulness does not stop with their families but spreads in an ever-widening circle to include the whole community and its problems; and to experience that keener, fuller, truer happiness that comes not merely from doing their own personal jobs well, but also from aiding fellowmen.

The first type of man is statically, passively happy, healthy and useful. The second is dynamically, actively happy, healthy and useful. And there is a world of difference between them!

FOUR "DIMENSIONS" IN A MAN'S BEING

Man building is the greatest business in the world. The job of making men can best be achieved by developing simultaneously the four fundamental parts of man's being. The head, heart and hand all need training to the end that the boy may have a keen intellect, a sound character, and an active, healthy and enduring body. Furthermore, if the boy is to grow into a really useful man, there must be implanted in him high desires. His head, heart and hand need direction. There must be some quality that will determine the use to which they are put. Every man needs what might be called volition or action qualities that will translate into activity the products of the other three parts of his nature. The head, heart and hand need a general to command their activity and to determine the uses to which they are put.

Man-power can be expressed by a quadrangle each side of which is represented by one of man's four dimensions. If any one dimension is short, his power is diminished by just that amount. We must, therefore, build intelligence, character, physical soundness and volitional power.

ABILITY, THE FIRST ATTRIBUTE

To build men who can live and love and serve in the highest degree, we must develop certain latent characteristics of mind and character. First comes the personal attribute of ability, or intellectual-thinking, remembering and imagining. We must teach men to think, to look beneath the surface, weigh, examine, ponder, decide. We must teach men to remember, to store in the brain the many details that, put together, make up a treasure-trove of experience. We must show them how to imagine, how to put themselves in the positions of others, to view the problems of life and living through the eyes of fellow-men so that their judgments may be well considered, fair and equitable.

Remembering provides a background of facts; thinking and imagining make use of these facts in anticipating the future. Altogether one's capacity to think, remember and imagine pretty accurately measures one's latent ability.

RELIABILITY, THE SECOND GREAT TRAIT

The second great trait we must develop in man is the attribute of Reliability, that characteristic that springs from the exercise and direction of emotions—love, courage, faith, truth, service, responsibility, temperance, justice, honesty. It is my contention that no man is going to be very successful or very happy if he does not love the game, the business, the profession, that he is in. If one really loves "his game" he will honor it, he will make it an instrument of service, an expression of faith, and in turn "playing the game" one loves cultivates responsibility, moral courage, truth, temperance, justice, honesty—in short, all those attitudes and reactions that make for reliability and dependability.

THE MAN WITH A SOUND BODY HAS THE BETTER CHANCE

The third characteristic of the ideal man has to do with the body. Occasionally, a great man rises to the heights despite physical handicaps, but normally the man with the sound body has the better chance.

It is not for me to deal with the individual handicapped through congenital weakness in body or mind. Rather, as I progress, I am thinking of the "average" young man, no more, no less. It is not for me to treat the subject from any save the simplest rules of hygiene that every layman knows, or should know.

First is the subject of food. Diet must be well balanced and neither more nor less than the body needs for its proper physiological equilibrium. Much food is prepared to "tickle the taste" and without any regard for its real food values.

Exercise comes second. This is important. I venture to assert that not one man out of ten today gets enough of this man-building and life-stimulating benefit. Muscular tone, stimulation of the viscera, assistance in elimination, growth and development to greater powers —these come from the right kind of exercise in the proper amount. Exercise is the law of growth, and this is true in the mental and moral as well as the physical world.

Water is another vital thing. Most every one of us drinks far too little water. Air, not the superheated air of the city apartment, not the dry carbon dioxide laden air of the office, but fresh, clean, outdoor air in great quantities, is another essential for abundant health.

Sunshine is also vitally important. The actinic rays from the sun have a great therapeutic value and I am told that heliotherapy has

become an important measure in modern medical practice. My medical friends also tell me that if a room in which there has been contagion should be flooded with bright sunlight for a time, no fumigation would be necessary. It stands to reason that sunshine would exercise just as beneficial an effect in removing impurities from the human body. Germs and bacteria do not like the sunshine; our bodies do. Air, water and sunshine all can be had practically without cost, still we refuse to make full use of them.

Recreation of the sort that relaxes the mind and exercises the body is another thing we humans should have. If a man works out-of-doors all day long in vigorous exercise, fussing with the radio will prove a good recreation for him. And, on the contrary, if a man leads a sedentary life in a stuffy office through the day, the ideal recreation for him is one that will free and relax his mind and exercise his body at the same time. It would be difficult to estimate how many years the game of golf has added to the life of the American business man, but it has certainly added a goodly number. As far as I can observe, the thing we call civilization does everything possible to eliminate exercise and we must determine, intentionally, to counteract this tendency.

Sleep, the deep, untroubled sleep wherein the body is perfectly relaxed, plays a great rôle in man building. The number of hours required depends upon the individual. Thomas Edison, it is said, has lived a long life of usefulness on four hours of sleep. Napoleon, that bundle of dynamic energy, slept, we are told, only four hours out of twenty-four. But the average person needs at least eight hours of sleep. If one-third of one's lifetime is to be spent in bed, one should see to it that this unconscious one-third of life renders him the greatest amount of benefit. Fresh air, just enough bodily warmth, a comfortable bed—these are important to promote healthful sleep.

LIVE, LOVE AND SERVE

If food, exercise, water, air, sunshine, recreation and sleep are of the right kind and of the right amount, no mentally healthy man should fail to arrive at a goal wherein he "thinks right." And thinking exercises enormous influence over bodily health. Wholesome, active, constructive thoughts habitually in the mind result in favorable physical and mental reactions, such as vigor and optimism.

My ideal of manhood is expressed by the citizen who has an active, vigorous, imaginative mind; who lives, loves and serves with faith, courage and honesty; whose body can aid and abet him in his active services and, lastly, who goes about these jobs of life with a clean, optimistic, wholesome mind and attitude. He may never reach the heights, his name may never be emblazoned in the headlines, but he

has truly lived and truly served and will reap whatever reward there is for the true and faithful servant.

My job has many man-building phases. I deal with youth, plastic, elastic youth. To me and my associates at the University of Michigan come opportunities for service that are many and unique. In my work as Director of Athletics and as a teacher of the strategy of football, it has been my rare privilege to watch youthful traits of mind guided into proper channels and, as the years have rolled by, one by one, to see these men succeed, or, as has much less frequently happened, fail. From these observations, this simple and perhaps trite philosophy has been evolved. Yet it is all-embracing, fundamentally sound and true.

MAN BUILDING ON THE FOOTBALL FIELD

On the football field, the four points of manhood are taught and demonstrated fully, completely, satisfyingly. The ability to use the intellect in thinking, remembering and imagining is readily apparent. To excel—and that is the goal of all our boys—they must be alert. They must remember the lessons they find. And they must project their minds, place themselves in the positions of their opponents and try to figure out or imagine, if you please, what will happen next and how they can combat it. Our football player must have every characteristic of reliability. Love on the football field? To be sure! Love for team-mate so that there may be cooperation and mutual understanding. Love for the game itself, so that it may remain unsullied. Service also. The desire is developed in each player to do more than his own part, to bear some of his comrade's brunt of the burden. Responsibility is equally well taught. When a signal is called, each player knows that he has a definite, personal assignment, that the success of the play depends upon the fulfillment of his part of the task. Faith in his fellows is the foundation of team play. Courage to fling himself into the fray. Wishbones are not much good on the athletic field—it requires backbone. Justice to his opponent and to his team-mates—these, too, are exemplified every moment.

COMBINE CHARACTER BUILDING WITH EXERCISE AND RECREATION

The football player is taught the importance of bodily fitness and the part that food, exercise, water, air, sunshine, recreation, sleep and mental attitude play. These are working-tools in his own personal football kit and he must keep every one of these keen-edged. The same qualities are developed, to a greater or lesser degree, in baseball, basketball and every other competitive sport. The athlete must live clean, think clean and come clean if he is to give himself a fair chance to win.

My whole thesis is that competitive athletics can play as important a rôle in Race Betterment as eugenics, sociology and the other many-sided sciences that must contribute to this greatest work of all. No one is self-sufficient. In this day and age, when the act of pushing the button or turning on the electricity has made physical exercise more or less unnecessary, we must look to sports to supply this crying need. And if, as is the case with properly conducted competitive athletics in high schools and colleges, *we can combine character building with exercise and recreation,* we have made a double-sided contribution to humanity's health and happiness and capacity for service. We have helped make a Better Race.

IDEALS IN ATHLETICS FOR WOMEN

How They Are Being Organized Nationally Along Lines of Health Protection and Improvement

Miss Mabel Lee, Director Women's Gymnasium, University of Nebraska.

Athletics for women! What magic may be held in these words! A force for good? A force for evil? It all depends upon their organization and supervision. Fortunately for American womanhood, and for American manhood as well, the national organization and supervision of women's athletics are today in capable and efficient hands.

In years past athletics existed only for the school girl, and even for her only in a hit-or-miss unorganized fashion. Her opportunities have been nothing compared to those of her brother. But times are changing. The great impetus given to athletics for men by the World War has gradually made itself felt in the woman's world, so that today we have many fine national organizations to foster and to protect the athletic interests of all our girls and women.

As recently as twelve to fifteen years ago, athletics for women were limited almost entirely to the first class colleges, to the public schools of the large centers and to that group of small-town communities that felt called upon to advertise themselves through the channel of a winning girls' basketball team. Now splendid organizations are at work reaching into all colleges, all public schools, even those of the small villages and rural centers, and into most industrial and business organizations. Women's athletic clubs are springing up all over the country—clubs for the woman past her school days, clubs for the girl in the factory, clubs for the girl in the business world, clubs for the girl in the home. Departments of physical education in the educational world are forgetting formal gymnastics and are sending the girls out-of-doors to play hockey, tennis, golf, volley ball, for horse-back riding, bicycling and hiking.

America is learning to take her rightful place as an outstanding leader in the world of women's athletics. But by that I do not mean that we are striving to turn out world championship teams. Women's athletics are being moulded in America today along other and more worthwhile lines. Health improvement and health protection are the two great thoughts encompassing our national slogan. "Play for play's sake and play for all."

THE PRICE PAID FOR A MOMENT OF "GLORY"

Yet we are working in some quarters at a great disadvantage. You men can help us by refusing to lend your interest and support to those men's clubs that are attempting to organize women's athletics apparently for the sole purpose of commercializing this growing force. These clubs are powerful and are recognized by the press. They care nothing for ideals, and health—just record, publicity and gate receipts.

When you read the Sunday Supplements and see the pictures of the girls taking hurdles, breaking the tape at the finish of a race, jumping and pole vaulting, all of them invariably clothed in immodest attire and hailed as America's own women champions—when you see all this, aren't you a little bit ashamed of America's own?

Have you ever stopped to wonder who or what is back of those girls? Have you ever stopped to think of the price those girls must pay for their moment of "glory"? A price to be paid in wrong social values most probably, and a price to be paid in broken health most certainly. Hard-fought-for championships always mean physical *straining*. If the world is to be benefited by physical training it is *worth* the price that *must* be paid. But what will it ever benefit the world to have a nineteen-year-old girl swim the English channel or another girl vault over a pole higher than can a girl of some other nation, or run one hundred yards faster than anyone else? "What price glory?"

Do not think I am not an ardent advocate of hurdling, swimming, and racing. These things are excellent in their place and when properly supervised, but when they are used as tools for cheap and vulgar publicity, and are indulged in to excess and to a point dangerous to the health of the individual, then they are decidedly out of place.

FORERUNNERS OF A GREAT MOVEMENT FOR GOOD

But what of our own women's organizations? There are many of them today, all organized since the War:

Field Hockey Clubs. America now has its hockey clubs and its All-American team, although little is said of it in the papers. For many years hockey clubs have been popular in the British Isles. Although the game has been played in our American colleges for twenty-five years at least, it has never been played with the splendid technique and finish given it by our foreign sisters.

Five years ago a team of English women visited this country, gave exhibition games and played our eastern clubs. Four years ago an All-American team invaded England, Scotland, and Ireland—not to determine the supremacy of the nations as the athletic male of the species so ridiculously loves to think he is doing, but to have the joy of

playing foreign teams, to observe their methods, to learn thereby, and, perhaps best of all, to get acquainted with those strangers through this great common bond, love of the game of field hockey.

Three years ago an All-England team once more toured the country, and two years ago an All-Ireland team visited us and played with our clubs as far west as Chicago and Madison. The press has had little to say about any of these four tours. They were in no way sensational. Scores of the games were in no way stressed. The joy of playing was the main feature. But they are the forerunners of what may be a great movement for good for our American womanhood. Already interest in these clubs is arousing many women who formerly found life a rather exerciseless existence after their school days.

IDEALS AND HEALTH INTEREST VERSUS WORLD RECORDS

Athletic Conference of American College Women. The college girl herself now has her national organization known as the Athletic Conference of American College Women. It was started nine years ago by the Women's Athletic Association of the University of Wisconsin. It now has on its membership roll every university and college of rank in the country. It meets in convention every three years, each time in a different section of the United States, and is controlled exclusively by the college girl herself. At its first national meeting, which was held in Chicago, it took a definite stand against inter-collegiate athletics for women. After heated debate on the subject at the triennial meeting at the University of California in 1924, they warned all colleges supporting any form of intercollegiate athletics for women and at the same time holding membership in this organization to abolish such athletics before the next meeting. I wish that I might have the time to go into this problem of inter-collegiate and inter-scholastic athletics with you. To an audience made up so largely of men, I would love to bring our woman's viewpoint.

Where are the people who say the college girl of today is materialistic, entirely frivolous, has no ideals? I wish they might attend one of these national meetings, see these clear-eyed, thoughtful girls and listen to them talk earnestly in behalf of ideals and health interests rather than of world records and winning teams. Athletics for women will always be safe if the type of our college athletic girl of today can maintain her leadership.

State Leagues for High School Girls. Many high school girls have their state organizations now, known as State Leagues. They are growing in popularity all over the nation. We have just completed the organization of our Nebraska State League of High School Girls' Athletic Associations.

The purpose of these leagues is to protect the high school girl in her athletics, to promote for *all* high school girls healthful recreation, and to organize their play in such a way that there will be sponsored activities in which every type of girl may participate, but this participation supervised for health interests and not fostered for championship competitions. The most vicious form of athletics in our country today is that carried on by some of our high schools. These leagues will soon replace that type with sane athletics.

NO LONGER EXCUSE FOR WOMEN USING MEN'S RULES

Women's National Athletic Committee. Another organization founded in very recent years is the Women's National Athletic Committee of the American Physical Education Association. This Committee has six sub-committees, one on field hockey, one on soccer, one on baseball, one on swimming, one on track and field and one on moderate sports, all for women. Each sub-committee serves as a national advisory staff and clearing house for information concerning official rules, management and conduct of its particular branch of athletics. There is now no longer any excuse for women using men's rules and guides in any sports since this committee formulates all rules for women and does this work through close contact with actual athletic conditions all over the country. There are representatives on these committees from all states of the Union, so that their work actually has a national scope.

AN INGENIOUS SCHEME FOR PROTECTING ATHLETIC IDEALS

National Amateur Athletic Federation. The last organization I will mention is the greatest of all. It embraces all of them. It is the mother organization of all groups of girls and women in the United States who are interested in promoting athletics. It is known as the Women's Division of the National Amateur Athletic Federation. It is now four years old. This Federation itself embraces all men's and all women's athletic organizations, the National Collegiate Association, United States Army and the United States Navy being only three of the many groups making up the whole Federation. All women's groups are in the Women's Division. Some of the groups belonging to this division are the National Y. W. C. A., Y. W. H. A., Girl Scouts of America, Girl Reserves, Campfire Girls, Athletic Conference of American College Women, Women's Field Hockey Association, Industrial Athletic Clubs, Departments of Physical Education for Women in all leading colleges of the country and the various State Leagues for high school girls. The General Federation of Women's Clubs is an endorser of the organization. Organized in Washington, D. C., in 1923 mainly through the efforts of Mrs. Herbert Hoover and

a group of women physical directors, it has enjoyed a tremendous growth.

Although its platform is a most idealistic one, it is putting teeth to its ideals by establishing a rating scheme for all its member organizations, a most ingenious and ambitious scheme based on its ideals, yet practical in its workings. The five purposes for its organization are:

1. To inaugurate and lead a national movement for sane and constructive athletics and physical recreation for the girls and women of America.
2. To bring together all groups interested in such activities for purposes of cooperation.
3. To formulate national standards for the sound conduct and development of girls' athletics.
4. To make possible for girls and women participation in athletic activity.
5. To serve as the national research body and clearing house for all problems of athletic and physical recreation for girls and women.

Its platform embodies intensely practical suggestions, such as these:

1. To promote athletics for the majority and not for the limited numbers chosen for their physical prowess.
2. To protect girl and women athletes from exploitation for the enjoyment of spectators.
3. To minimize the emphasis placed on the winning of championships.
4. To stress the sport and the group and not the individual.
5. To place the control of women's athletics in the hands of women.
6. To countenance never the sacrifice of an individual's health for the sake of her participation in athletic competition.
7. To promote the adoption of appropriate costumes for all sports.
8. To eliminate gate receipts for women's matches.

Through these splendid national regulations, we women who are interested in athletics feel that we are contributing materially to the betterment of American womanhood and through her to the Betterment of the Race.

We propose to have athletics for our girls and women, to have *much* of them, but we propose also to have them controlled by women, coached by women, officialed over by women, trained by women and protected by the medical profession. In this determination we are being aided in every way by the men of this country who are leaders in the attempt to bring order out of the chaos of men's athletics, and aided by both men and women who are striving to unite and to keep united athletics, health and ideals.

BUILDING CITIZENS

EUGENE T. LIES, Special Representative of the Playground and Recreation Association of America

Much has been said in late years about the meaning of citizenship and training for citizenship. Some of this has been good, some not so good, and some downright pernicious.

The spirit of autocracy has marked many an utterance and plan for making over the foreign-born into simon-pure Americans. It has been supposed at times that if a man would but bow to a behest to divest himself of all thought, word, deed, habiliments and everything else that suggested his relationship to some land beyond the seas, and then as soon as possible apply for citizenship papers, he would suddenly be metamorphized into a state of sound 100 per cent Americanism—all of which was, of course, nothing but Simon-pure folly.

It is certainly not that kind of thing that I am thinking of in discoursing upon the subject "Building Citizens." I am thinking, rather, of what can be done with normal raw human material to fit it to live amply in a democracy pulsating with life, shot through with all the complexities of modern civilization.

No weakling in body, mind and character, thrust into the midst of present day highly organized life, can hope to be happy or efficient or of much service to his fellow men.

It is, of course, the child about whom we are most concerned, as to whether, in the face of the kind of world we bring him into, we have wisdom enough to rear him so that he will in all necessary ways be fit to meet victoriously the buffetings of inimical influences on the one hand, and to take his place as a constructive and creative factor on the other.

Twenty years ago Dr. Woods Hutchinson raised the question seriously as to whether the child could survive civilization, in view of the kind of environment surrounding him. "It makes little difference," he declared, "how perfect our civilization may be for the well-being of adults. If it assumes such a form that children cannot grow up healthy and vigorous under it, it is doomed." The doctor had in mind the rapid growth and congestion of cities, with their increasing occupation of land formerly used as natural play places; the rapidly changing conditions in the home whereby children were being deprived of the old-time training inherent in the doing of chores and the making of things; the over-organization of indoor schooling, and the increasing

automatization of industry that has tended to the choking of creative ability in workers.

Well, much water has gone over the dam since the doctor expressed himself as he did. While cities have gone right on growing, both horizontally and vertically, eating up ground a-plenty, and while the home has continued to lose more and more of its manufacturing functions, and while the automatic machine has almost come to the dominating point in industry, still some other things have been happening also that must give hope and cheer to all who are interested in human processes.

GREAT PHILOSOPHERS AND EDUCATORS HAVE PROCLAIMED THE EDUCATIONAL POSSIBILITIES OF PLAY

Professionally interested as I am in the field of play and recreation, I purpose to set forth the place that play has achieved in the program of citizen-building in the last two decades or so in America. True it is that it was not in this period that play as a necessary factor in child development was first discovered. No, it was a long, long time ago when that discovery was made; it was in the days of Athens at her best when such marvelous results were attained from its utilization in a systematic way. Quintilian, Fenelon, Comenius, Locke, Rousseau, Basedow, Gutsmuths, Groos and Gulick, to mention but a few of the philosophers and educators, all have in their day proclaimed the educational possibilities of play, and it was Froebel who worked out in a systematic manner the program that has influenced so markedly our modern ideas of fundamental human artistry.

But I believe it is safe to say that his ideas and those of his immediate disciples were not really incorporated into our schemes of child training with any degree of whole-hearted enthusiasm until in these latter years. We seem to have been very tardy in getting a grip on their significance. Furthermore, many a follower of Froebel has degraded his principles through over-organization and formalism, and they have had to be rediscovered and revitalized.

CONDITIONS THAT HAVE AROUSED THOUGHTFUL LEADERS

The steady aggravation of those conditions adversely affecting the welfare of the child and of youth, which Dr. Hutchinson called attention to, has aroused increasing numbers of thoughtful leaders in many different walks of life to consider anew the meaning and possibilities of constructive play in the development and conservation of normal, wholesome life.

In addition, there have been other considerations that have stimulated a veritable renaissance of interest in the subject, and also practical

action of wide significance. I have in mind, among other things, the revelations of physical defects and inefficiences in school children as a result of the medical inspection movement; similar revelations in respect to the young men who went through the draft examinations in the Great War, one-third having been found below par; then, too, the keener realization that our prevailing educational processes were not producing citizens adequately fitted for living and functioning in a new world, high-geared and highly organized; also, the phenomenon of the ever-growing leisure of our time, put at the disposal not of the few but of all the people, with the recognition of its potentiality as either a great asset or a great liability, and, on the other hand, the universal spread of commercial amusements in America.

All these things, together with the scientific findings in the fields of physiology, psychology, psychiatry and experimental pedagogy as to the essential processes of growth in children, have turned attention as never before to the principle of play, both as a motivating power and as a vital ingredient in any program of genuine citizen-building.

In 1906 the Playground and Recreation Association of America was formed for the purpose of crystalizing, and of putting to work in a nation-wide movement, what the play philosophers and teachers had been thinking out up to that time. It has been busy ever since with public education, further investigation and experiment and with practical effort. Dr. Luther Gulick was its first President and continued President for several years. Joseph Lee of Boston succeeded him. Mr. Lee, possibly America's outstanding thinker in this field, is still serving as President.

PLAY A NECESSARY INGREDIENT IN A BALANCED RATION OF LIVING FOR ALL PEOPLE

Now, it is interesting to note that whereas twenty-one years ago this organization considered its immediate duty to be the getting of playgrounds for small children in the poorest tenement sections of great cities, today it is saying emphatically to the world that play is a necessary ingredient in a balanced ration of living for all people, young and old, rich and poor, wherever they may live. The implications of such a doctrine are certainly very wide and touch life at many points, but they are being rapidly accepted in America. (Nothing here said should be considered as ignoring the contribution of other agencies, like, for example, the Y. M. C. A. and the Y. W. C. A., in spreading the gospel of constructive play and recreation. Not at all. But it simply happens that the Playground and Recreation Association has been following as its province a rather wide field of public service, including that of public education.)

BROADCASTING THE BEST THOUGHT OF THE AGES ON PLAY

In its character as publicist, the Association has been attempting to pass on first to leaders and then to the general public the best thought of the ages as to the function of play in life and the many ways in which it can be applied in the home by parents and in the school by the regular teachers and the physical educational directors in order to make their program richer, more fruitful and more appealing. Upon the church it has been urging the character-building possibilities of play rightly handled. To civic leaders and municipal officials it has presented information and the benefit of much practical experience as to the setting up and manning of community recreation facilities. To legislators it has appealed for the passage of enabling laws to give municipalities power and money to conduct recreation systems. Also, through its National Physical Education Service Bureau, it has helped to secure legislation calling for modern physical education programs in the schools.

In the doing of its country-wide job it has had the effective cooperation of national and state organizations in the parent-teacher field and in the fields of education, health, social work, civic welfare, organized labor and religion.

In its efforts the Association has utilized about every known instrument and medium for getting results—the printed word, personal and general conferences, public addresses, publication of handbooks and more pretentious volumes, radio, surveys and exhibits, study courses, institutes, demonstrations, moving pictures, recreation congresses and legislation. It is still using all these methods and would appreciate suggestions of new ones.

There has been progress. Whereas, in 1906 there were possibly only a score of public playgrounds throughout the United States, in 1926 there were 10,123 play places of various kinds reported through our Year Book. These were in 790 cities which spent that year $19,200,000 for public recreation purposes. They employed 17,090 workers and had open to all their people 1,764 indoor play centers, 2,972 ball fields, 6,254 tennis courts, 693 swimming pools, 276 bathing beaches, 184 summer camps, 194 municipal golf courses and 1,506 skating places.

The programs of those communities that have gone furthest in their recreation development run the gauntlet all the way from physical and social activities to music, dramatics, pageantry, art and handcraft. Thus they are touching many sides of human need, satisfying many human hungers for expression.

Sixteen states now have recreation referendum laws, while twenty years ago there were no such laws. Thirty-five have enacted physical education legislation, twenty-four of them in the last eight years.

While there has been this encouraging advance, much more remains to be done. All those who have convictions about the important place of play in life have still plenty of room for the exercise of their talents of persuasion, for there still are extant some survivors of those who put the taboo upon play and call it wickedness and of those others who in their pride say, "Look at me! Nobody taught me how to play and in my day we didn't have any playgrounds." These latter folk are, of course, living in America's rural past; they have not yet discovered that the Civil War is over.

THE PLAYING CHILD IS THE ACCOMPLISHING CHILD

May we not profitably set forth some of the great truths about this matter of play both to enlighten the still unenlightened and to refresh our own convictions?

Play is the child's natural, proper business. It is the expression of an inner urge to growth. As Joseph Lee puts it, "It is only in his play that the child's whole power is called forth, that he gets himself entirely into what he does."

Through it, in large measure, will the child get that all-round development of those 13,000 million nerve cells with which the physiologists tell us he is endowed at birth; and that growth of muscles and healthy tissue, that vitality of organs, that balance and coordination of physical and mental powers which form the *sine qua non* of happy and efficient living.

Everlastingly is it true that the playing child is the accomplishing child, the learning child, the joyous child. He is leading the normal life, and that is the only kind he will lead—unless perchance some mischief-making, delinquent adults get in the way.

The non-playing child is the unhappy child. He leads a subnormal life. He is really sick and needs some kind of a doctor.

The playing child is a busy member of society, probably the busiest. He lives in the present. He lives in the past, and to some extent in the future.

THE "NATURAL" BOY

By the very powers of inner compulsion, step by step, he gropes for activity, ever more varied and complicated. With the help of the proper stimuli in his environment, he can re-enact and gather in much of the experience of the race. The great thing is that he does this not with dissatisfaction but with satisfaction. This is all pictured in colorful fashion by Professor George E. Johnson in his description of the natural boy. After calling him "a whole menagerie," he declares that this natural boy, if but given a fair chance—

"Crawls like a worm,
Creeps like a turtle,
Dives and swims like a frog,
Walks like a quadruped.
Climbs like a monkey,
Runs like a deer,
Squeals like a pig,
Screeches like a parrot,
Hoots like an owl,
Whistles like a mocking bird,
Sings like a lark.
He digs, builds, roams, hunts, pillages, tames wild animals and makes boon companions of dogs.
He dams streams, makes toy weapons.
He descends beneath the waters, under the snow and into the bowels of the earth;
He ascends to the housetops, into the trees and there abides;
He tries the heavens with flying toys, arrows, balloons, kites and aeroplanes.
He conjures with the stars, creates mysteries.
Makes rhymes, composes songs and music, dances and fills the air with unearthly din.
He teases, mimics and acts many parts.
He competes, does stunts, undergoes ordeals, fights, forms gangs, organizes clubs and institutes rituals.
There is no creature in the heavens above or in the waters under the earth which he does not at times become."

"KEEP LIMBER, LOVING AND A LITTLE BIT LOONEY"

I ask you: Breathes there a man with soul so dead who ever in his heart *could* say: This is not the normal life for Willie or, indeed, for Mary, too? Show me that man and I'll show you one who has lost the spirit of play, the spirit of youth, one who is in decay. He and his ilk are they who contribute so much to what we call our "juvenile delinquency problem." They probably never knew that prescription for growing old gracefully: "Keep limber, loving and a little bit looney." They need it. If they knew it and regularly followed it, they would better understand child nature, be healthier, less grouchy, more fit to live with. "Unless ye become as little children ye shall not enter into the Kingdom of Heaven." Also, Herbert Spencer said, "We stop playing, not because we grow old; we grow old because we stop playing."

THE CHILD RECAPITULATES THE PAST AS HE CONQUERS THE PRESENT

But we are traveling a bit fast. And so, often, does the playing child. While in his play the child seems to be recapitulating the past, he is also conquering the present. He is getting to know his world about him. He is touching it at many points, seeing how it works, using it,

learning it in its time and space aspects, finding out what it is made of, learning more and more of its contents. He is inquisitive. He is a Columbus.

He discovers, too, that he is not alone on this earth. There are others. He tries the others out in his play and is in turn tried out by them. They match qualities and powers. In finding out that these others have egos, too, our playing child learns his priceless lesson of give and take, self-control.

He early concludes that in the present is reality. The earth under him is fixed, but we can dig into it and move about on it. The breezes blow and carry things away. The tree branches sway and he can sway with them. The waters flow and upon their bosoms objects float, and he, this playing child, can dive beneath them and around them.

THE CHEATED CHILD VERSUS THE CHILD THAT FOLLOWS THE GREAT CREATOR'S PROGRAM

But how well we know that all the boys and all the girls of all the world have not at hand sea and sun, hill and dale, trees and grass, love and cheer. They who have not are the cheated ones. They cannot live the normal life. The "makings" are not there.

The playing child is the developing child. He is growing from helplessness to self-helpfulness. He is successfully on his way. He is following the Great Creator's program laid out for him.

In his races and competitions, the playing youth struggles against obstacles within and without. He learns self-mastery. In his group games he plays a part in a whole. He becomes a cooperating factor in his society, an important factor. His strength and skill are coupled with the strength and skill of team-mates against a rival group. He is living under constitution and by-laws to which he himself has subscribed. Nobody forced him into the game; he entered of his own volition, knowing that a government would control him.

The government says he must play fair, keep his temper, abide by decisions of arbiters. Here certainly is training *for* life, as well as being life itself. Here certainly is education for a later career of accomplishment in the workaday world, as well as keen satisfaction in the present.

Courage, loyalty, perseverance, ambition, imagination, judgment, resourcefulness, enthusiasm—all these mental and spiritual qualities does the all-round playing child and youth have inculcated in him.

SPIRITUAL QUALITIES INCULCATED

And he likes the process! That's the important thing for us adults to remember, he likes the process! Preach at him to be courageous,

loyal, persevering, ambitious, etc., and where do we get? Oh, probably some of our sermon gets below the skin, but how little! We come here to the thought of the *theory* of duty versus the *love* of duty. The more we study the subject, the more clearly we see that constructive play is one of the most powerful educational instruments we have for reaching "the very inners" of the growing child, for tapping his finest resources of personality and, at the same time, laying strength on strength for the physical being by building muscle and nerve-force, developing breathing power, promoting blood circulation and endurance and coordinating the elements in the bodily machinery for the multitudinous emergency demands that inevitably will be made upon it later.

The psychologist, Seashore, tells us that "play is the principal instrument of growth. Without play, there would be no normal adult cognitive life; without play, no healthful development of affective life, no full development of the power of the will." Why, oh why is it that our schools have been so tardy in utilizing this instrument of growth? But they are getting on their job, for we should know that among the seven great objectives of education in the platform of the National Education Association are Health and Training for the Worthy Use of Leisure. Therein lies great hope for the welfare of America.

Listen to the sociologist, Edward A. Ross: "The playground offers experience in an animated, stimulating, miniature society that presents many of the situations one encounters later in adult life. It forms the cooperator, the competitor, the rival, the follower, the comrade."

GUIDANCE NECESSARY FOR MOST FRUITFUL GRATIFICATION OF PLAY HUNGER

We are not forgetting, indeed, that these excellencies of result from play cannot all come spontaneously, i. e., not in these days of complex and artificial living. No, there must be some guiding hand, a knowing intelligence, supervision in the real sense of the word, higher vision. The child has, it is true, a natural hunger for play, but it also has a natural hunger for food. We do not have to provide the hungers, but both do call for guidance into safe expression, safe gratification, yet not only safe gratification but the best and most fruitful gratification. The right objects and the right channels to them, the right circumstances, must be provided. Then will follow the greatest fruits.

Of course, part of wise supervision means pretty much "hands off" at times, but that's where wisdom comes in.

Right leadership will also mean the planting of recreation interests in such ways as to be abiding through life. It will nurture the "keep-fit" principle.

THE GREAT TESTING TIME FOR YOUTH

And how vitally important is such *super*-vision as the adolescent age comes along in our young people, that age when they are no longer children nor yet adults, that nondescript period, that time when the world beckons to them to leave old moorings, the hectic world with its growing allurements, its sirens, its tinsel and bells, its paste jewels, its fake beauties, its ash-filled apples, its veneered scenery, its call of the wild—and yet with its unblemished beauties and joys and music just around the corner.

Here is the great testing time for youth, yes, the testing time for all adults who brought youth so far, up to this age.

For true it is that if those adults have hitherto done well their part in the training process; if they have all along used constructive play, among other means, as an instrument for the development of right attitudes, for training in personality, in real character, for habituation in joyous, wholesome expression, then at least half the battle has been won. Tastes will have been planted; right attitudes as to the worthy use of free time will have been formed. But further guidance is absolutely essential.

FORCES THAT POLLUTE INNOCENCE AND DAMN SOULS

For battle it is from now on between the opposing forces in the recreation field. If those who have the destiny of young people in their hands are asleep, then the forces that pollute innocence and damn souls win out. Parents, teachers, social and civic leaders must be eternally on their job or *they* face indictment as delinquent.

One of their jobs is to oppose and throttle to the death those types of amusements that may be called wholesale destroyers of youth. To be specific, I mean indecent commercial dance halls, gambling dens in the guise of something else, rotten movies, most of the traveling carnivals, vile cheap magazines with which the country is flooded, etc., etc.

UNDERSTANDING THE INNER SPIRIT—MECHANISM OF THE TEEN-AGE

But this is not their only job. That much is only protection. Police work and the exact methods for carrying it out, I am not here prescribing. Their next job is that of *understanding* the needs of youth as youth, and this is no task for a fool. Here is where real exertion is called for, real sympathy, too, and one ought to be able to add, a sense of delightful opportunity ahead.

The inner spirit-mechanism of teen-age human beings is, as we all know, a complicated thing, ofttimes baffling and elusive. To hope to guide it in the young people of this rushing, bustling era, when stimuli beat in upon them hour by hour from a thousand sources we knew not

of in our own youth, we adults must know infinitely more than most of us do yet know about human psychology and psychiatry.

Still, even out of our own experience we should realize that youth loves color, adventure, cheer, social contact, new life, yes, music and art, dramatics and handicraft. Yet, how tragically often when it calls for such soul food do we give it a stone!

THE GROPING FOR "HEIGHTENED EXPERIENCE"

The first step toward delinquency, says Dr. Miriam Van Waters, Referee of the Juvenile Court of Los Angeles, one of the keenest students in her field, is usually related to the groping for "heightened experience," in other words, the desire for play adventure. And it is in the beginning a wholesome, a right desire, but it so easily gets frustrated or twisted or misapplied, and then begins the mischief.

The logic of this whole situation is so clear it hardly needs to be stated for the enlightenment of this particular audience, but for the enlightenment and awakening of the unenlightened, the dull-witted, complacent folk, the untold number of adults who themselves are caught in the whirlpool of our present-day complicated living, we who *know* must crash in upon *their* consciousness with our revealing truth.

YOUTH WILL NOT BE DENIED

The truth we must reveal is that more attention than ever before in our history must be given to the matter of provision of the right kind of play and recreation opportunities for our young people, the right kind in the right places, under the right auspices, in order to satisfy that natural hunger for self-expression. This means careful planning, adaptation, the application of experience, the skilled manning of programs. There is no higher, finer task for social statesmanship than this. The real thinkers in the fields of health, education, psychiatry, social hygiene and religion are quite in accord today with this opinion. They know that the first eighteen years offer us our great and golden opportunity for giving right set to body, mind and spirit.

They are recognizing that these hungers for expression are legitimate and should be regarded as healthy aspirations, as demands for release from prisons, burstings of soul force, keen desires to live the normal life.

They know that the balking of these desires or their mis-expression spells abnormal life, delinquency. Youth will not be denied.

They know that more than ever strong bodies, reserve nervous force, power of adaptability and social fitness are needed to meet the demands of a strenuous age, and that constructive recreation processes offer one splendid way of building them in youth.

WE SHOULD TRAIN FOR LEISURE

Those thoughtful leaders know that today there is vastly more leisure in which, for weal or woe, these desires *will* get satisfaction, and that this leisure needs to be organized as much as does industry, as George Eliot declared years ago. Comparatively speaking it is, as many sociologists have pointed out, one of our greatest unsolved problems. Somebody has worked out the conclusion that in a man's lifetime of three score and ten there are on the whole only twelve solid years of work, but twenty-nine for leisure and the rest for sleep; and that if it is important to train for work, it is therefore more than twice as important to train for leisure. But how woefully inadequately as yet are we providing that training!

Maeterlinck said long ago: "Tell me how a people uses its leisure and I will tell you the quality of its civilization."

Professor Norman E. Richardson of the Religious Education Department of Northwestern University gives it as his opinion that "the task of training the present generation for leisure is an undertaking the magnitude of which cannot readily be encompassed even by the most active imagination. No generation in the history of the race has had so much free time placed at its disposal."

Professor John Dewey, the seer of modern educational philosophy, reminds us that "if education does not afford opportunity for wholesome recreation and train capacity for seeking and finding it, the suppressed instincts find all sorts of illicit outlets, sometimes overt, sometimes confined to indulgence of the imagination. Education has no more serious responsibility than the making of adequate provision for enjoyment of recreative leisure; not only for the sake of immediate health, but still more if possible for the sake of its lasting effect upon habits of mind."

IT IS BETTER TO FORM THAN TO REFORM

Society is all too ready to build jails, reformatories and prisons for punishment and reformation of those who go wrong during their free time, but surely it is better to form than to reform; build than rebuild; prepare and prevent than wait—wait until we must repair and repent.

We have done altogether too much waiting. We need to remember that our total crime bill today, according to some estimates, has mounted to the stupendous sum of ten billion dollars per year! Surely it is high time that we should blazon imperishably upon the skies for all to read the truth that one potent, proved means of stemming the tide is to universalize the application of this idea of constructive play under wise direction.

HEADQUARTERS OF THE CONFERENCE
MAIN BUILDING OF THE BATTLE CREEK SANITARIUM

Our general program, town by town, city by city, must be carefully worked out, in each case to fit local conditions. But experience proves that, to be most effective, it needs to incorporate into its scheme the home, the school, the church, the specialized agencies and the community. There must be no loopholes. Each has its part in the ensemble effort. Each must play into the hands of the other. Not one alone, nor two or three of them, but all are needed if we are to get anywhere.

A rich, appealing program of physical education in the schools, more and better playgrounds, athletic fields, social centers, opportunities for musical, dramatic and art expression, under wise leadership, will result.

PLAY CAN ADD YEARS TO LIFE AND LIFE TO YEARS

In all of such planning, of course, the adult must not be forgotten. He needs recreation in forms adapted to his condition, if he is to avert unnecessary ills in and after middle life (as even the insurance companies are now warning us), and thus prolong a cheerful, glowing existence into the twilight days well beyond the traditional three score and ten. He can, if he will keep the forward-looking spirit of youth. Play can add years to his life and life to his years. Premature breakdown will soon be considered a disgrace.

At the center of all our effort must be organization, to which ever new wisdom should be added. The Playground and Recreation Association of America offers its twenty-one years' experience to communities for studying their recreational needs, for mapping out a workable program, for furnishing and training of workers, and offers continuous advisory assistance.

NOT MERELY TO LIVE, BUT TO LIVE BIG

The whole issue is so vital to the welfare of America that it must be grappled with in a large way. The youth of our land are so immeasurably precious that we should at any cost, in money and effort, be joyously concerned to make it possible for them to lead the normal life, which is, in so large a measure, the life of abounding health, of creative expression, of wholesome comradeship, the efficient life, the life of service, the life of happiness. The normal life, rightly conceived, is the abundant life. And building citizens should mean for us, in the last analysis, building them with capacities for leading the abundant life.

To keep people merely alive is a more or less worthy objective, but to help them keep vibrant and ever keen for new adventure is a triumphant achievement. Not merely to live, but to live big; not merely to live big physically, but also to live big mentally, to live big imaginatively, to live big emotionally and spiritually—Ah! *That Is Life!*

MOTION PICTURE PROGRAM

The Immortality of Animal Tissues
Dr. Alexis Carrel,
The Rockefeller Institute for Medical Research

Malaria
The Rockefeller Foundation

Unhooking the Hookworm
The Rockefeller Foundation

Sun Babies
The Children's Bureau, United States Department of Labor

Posture
The Children's Bureau, United States Department of Labor

Well Born
The Children's Bureau, United States Department of Labor

The Woman Worker
The Women's Bureau, United States Department of Labor

Urology and Longevity
Dr. Oswald S. Lowsley

Alcohol and Human Efficiency
Carnegie Institution of Washington

Periodic Health Examinations
Life Extension Institute, Inc.

The Sunshine Playground
Battle Creek Sanitarium

The Tobacco Plague
Battle Creek Sanitarium

Activities of White Blood Cells
Battle Creek Sanitarium

THE "OLD-AMERICAN" PARTY

AN ENTERTAINMENT FEATURE OF THE THIRD RACE BETTERMENT CONFERENCE
(Under the Direction of Benjamin Lovett, by Courtesy of Mr. Henry Ford.
Mr. and Mrs. Ford in the Foreground)

REPORT OF THE EXECUTIVE SECRETARY

The third of the Race Betterment Conferences, held under the auspices of the Race Betterment Foundation of Battle Creek, Michigan, had for its purpose—as did previous Conferences—the bringing together of a group of leading scientists, educators and medical men, to discuss ways and means of applying science to human living in the promotion of longer life, of increased efficiency and well-being, and race improvement.

Fortunately for the Conference, Dr. C. C. Little, President of the University of Michigan, consented to serve as President and to supervise the creation of the program, which aimed to give all possible impetus to a more widespread knowledge of Eugenics and an increased practical application of its principles. All the papers read before the Conference are published in full in these Proceedings. In addition to the subject of Eugenics, the papers read discussed numerous other subjects pertaining to Race Betterment, such as Personal and Public Hygiene, Industrial Sanitary Science, Rural Hygiene, Child Hygiene, Nutrition, Bacteriology, Chemistry, Physiology, Physics, Medicine, Education and Scientific Research.

THE FITTER FAMILIES CONTEST

In order to give practical visualization to the factors involved in Heredity, Eugenics and Hygiene, and to make an objective demonstration, a Fitter Families Contest was held during the Conference. The Contest was conducted by the American Eugenics Society, Inc., under the direction of Mr. Leon F. Whitney, Executive Secretary of the Society. The practical work of the examinations was supervised by Dr. Florence Brown Sherbon, Director of the Bureau of Child Research, University of Kansas. The corps of specialists for making the examinations was drawn from the Battle Creek Sanitarium and Battle Creek College, Dr. Luther S. West, Head of the Department of Biology at the College, acting as Chairman. A full report of the Contest is included in these Proceedings, together with an analytical study of the data obtained.

SESSIONS AND AUDIENCES

One hundred and seventy-five official Delegates were registered for the sessions, besides the unofficial Guests. The meetings began with the Monday afternoon session, January 2nd, and continued, with morn-

ing, afternoon and evening sessions, through Friday evening, January 6th. The local interest was lively, and swelled the attendance at all sessions to a minimum of 500 for morning sessions and of 2,500 for evening sessions. Morning and afternoon sessions were held in the Battle Creek Sanitarium gymnasium, as were all evening sessions except the session on Tuesday, January 3rd, which was held in the spacious Sanitarium Union.

The Chairmen for the various sessions were:

Dr. C. C. Little, President of the University of Michigan.
Hon. John W. Bailey, Mayor of the City of Battle Creek.
Dr. James W. Glover, Professor of Mathematics, University of Michigan.
Dr. Irving S. Cutter, Dean of the Medical School, Northwestern University.
Dr. Franklin H. Martin, Director General American College of Surgeons; President Gorgas Memorial Institute.
Dr. Henry F. Vaughan, Health Commissioner, City of Detroit.
Dr. Aldred Scott Warthin, President National Association of American Physicians; Director Pathological Laboratory, University of Michigan.
Dr. Irving Fisher, Professor of Political Economy, Yale University.
Dr. W. A. Evans, Professor of Hygiene, Northwestern University; Writer and Editor "How to Keep Well" Department, Chicago Tribune.
Dr. Edward Alsworth Ross, Professor of Sociology, University of Wisconsin.
Dr. Paul F. Voelker, President of Battle Creek College.

ENTERTAINMENT FEATURES

An "Old-American Party," under the direction of Mr. Benjamin Lovett, by courtesy of Mr. Henry Ford, was the most popular entertainment feature of the Conference week. Mr. Ford also extended to the Conference the courtesy of his Old Time Dance Orchestra. The party was held in the Sanitarium Union, where 2,500 people participated, a large number of them, including Mr. and Mrs. Henry Ford and the Conference Delegates, joining in the old-fashioned dancing, Mr. Lovett directing. Preceding the dancing a brief reception was held on the stage of the Sanitarium Union, by the Conference Reception Committee of fifteen members, for the official Delegates and Guests, and for Mr. and Mrs. Ford.

The basketball game between Varsity B of the University of Michigan and Western State Teachers' College, held in the Sanitarium Union between the afternoon and evening sessions of Wednesday, January 4th, drew an audience of 2,000 people for a fast and interesting game, marked by its cleanliness and absence of personal fouls. The game represented the inauguration of the new two-team idea at the University of Michigan, involving a principle considered by President Little to be in keeping with the Race Betterment movement. The game was won by the Western quintet by a score of 33 to 29.

The principal banquet was held on Monday evening, and was tendered by the Battle Creek Sanitarium, Host for the Conference, to 350

SEVEN VIVACIOUS LITTLE VEGETARIANS

Who Showed the Delegates to the Third Race Betterment Conference Something about the Joy of Living.
(Their watches were the gift of Mr. Henry Ford.)

official Delegates, Guests and Members of the Local Cooperating Committee. The speakers at the banquet were Dr. John Harvey Kellogg, Medical Director of the Battle Creek Sanitarium, and Honorable John W. Bailey, Mayor of Battle Creek. A full report of their addresses is included in these Proceedings.

Special private dinners were given by the Sanitarium and its Reception Committee to Mr. and Mrs. Ford, to the women delegates, to a group of delegates from Canada, to visitors from the University of Michigan, and to Dr. M. Hindhede, the Delegate from Denmark.

The Local Cooperating Committee and the participants in the Fitter Families Contest, together with the corps of experts who organized and supervised the work and made the examinations, were the guests at a special Sanitarium banquet at which the prizes were presented by Doctor Kellogg. A copy of his address is included in these Proceedings.

A charming light entertainment feature during the Conference was a brief program of music—solos, duets, trios, choruses—by the "seven vivacious little vegetarians" of the local Rucker family, whose pictures are included herewith.

Sight-seeing parties were organized for those Delegates and Guests who were interested in visiting the local food factories and points of special interest in Battle Creek.

EVIDENCES OF PUBLIC INTEREST IN RACE BETTERMENT

A lively interest in the ideals and the work of the Conference on the part of the general public was shown by the fact that more than 1,600 abstracts or stories were published, appearing in 574 newspapers, and not in one small section of the country only, but in every state of the Union with the exception of one. The published matter relating to the Conference aggregated more than 450,000 lines. In addition, abstracts and articles appeared in fifteen magazines in this country and abroad.

EXHIBITS

The American Eugenics Society exhibit consisted of panels graphically setting forth population problems by means of a light-flashing device and explanatory captions; also a pictorial plea for the keeping of family histories, and posters and a rotating sign explaining the purposes of the eugenics movement. Six possible Mendelian combinations of hereditary unit-characters were objectively demonstrated by means of a panel on which was fastened the actual animals (stuffed guinea pigs) in which the combinations had taken place.

A model sunshine playground, constructed by Miss Lorna Barber, assisted by Dr. B. F. Birkbeck, both of Battle Creek College, was exhibited in the Sanitarium Union. The model aimed to show how children may get the most from the sunlight, and furnished suggestions for making a playground practicable in any community.

EMILY F. ROBBINS,
Executive Secretary,
April 2nd, 1928.

Model of a Sunshine Playground

A BIOLOGIC BANQUET

For the Delegates to the Third Race Betterment Conference, in South Wing of the Dining Room of the Battle Creek Sanitarium, Host for the Conference

MESSAGES AND RESOLUTIONS

A GREETING TO THE CONFERENCE

MRS. MARY F. HENDERSON

The attention of the thinking men and women of America is at the present moment focused on Battle Creek, Michigan, where the Race Betterment Conference is in session at the Battle Creek Sanitarium. It is to be hoped that the body of distinguished scientific men and women gathered there will, by their deliberations and discussions, help to solve some of the great problems that must be solved to save the human race and to elevate man to a real aristocracy of health.

The world needs wise leaders to show the way out of the dark ages of degenerative habits and disease-producing customs, and to teach the canons of biologic and physiologic rectitude, thus standardizing human living on a scientific basis. Race Betterment through the application of science to human life is the world's greatest need.

AN ENDOWMENT FOR RACE BETTERMENT

Dr. John Harvey Kellogg announced to the Conference the presentation of a gift of two hundred thousand dollars ($200,000), besides a very valuable piece of real estate for the promotion of the Race Betterment work from Mrs. Mary F. Henderson of Washington, D. C., who besides being the author of "The Aristocracy of Health," has for thirty years promoted the ideals of biologic living and Race Betterment.

The following resolution was presented and carried unanimously:

"*Resolved* that the thanks of the Conference be expressed to Mrs. Mary F. Henderson, of Washington, D. C., for her work in behalf of Race Betterment, for her generous gifts to the movement, and for the provision that she has made for the future extension and permanent development of the work."

ANOTHER CONFERENCE REQUESTED

On behalf of the Resolutions Committee, Dr. William Alfred Sawyer presented two resolutions, which were carried unanimously. In making the presentation, he said:

"I do not know whether or not all of us realize what a feast has been going on here this week. This program has been a tremendous thing, not only to those of us who have been fortunate enough to be here, but to the world at large. The Delegates feel that some expression should be made of their gratitude and appreciation. We present, therefore, the following resolutions:

"*Resolved* that we thank the Race Betterment Foundation for organizing this Conference and Dr. John Harvey Kellogg and the Battle Creek Sanitarium for acting as its Host, and that we hope a similar Conference will be held next year; also

"*Resolved* that we thank Dr. C. C. Little, for acting as President of the Conference, and Miss Emily F. Robbins for her work as Executive Secretary."

BATTLE CREEK'S HOSPITALITY

Honorable John W. Bailey, Mayor of the City of Battle Creek, and Chairman of the session at which the Resolutions were presented, added the following to the expressions of appreciation:

"Fourteen years ago I attended the First Race Betterment Conference and took some very little part as I have done in the Conference this year, and I am very glad to be here tonight to add my word of appreciation and of thanks to Dr. John Harvey Kellogg, who had the conception and executed the plan that made the Race Betterment Foundation possible. I sincerely hope and believe that the good work he thus has started will go marching on, and that he may be spared many years to take part therein.

"I also wish to add my word of appreciation to the Sanitarium Management for the splendid part they have taken in making the work possible and in making this meeting a success, and to thank them very sincerely for the very loyal way in which they have supported their chief, Doctor Kellogg.

"The whole meeting has been a grand success, and Battle Creek is very proud of it. We are all very glad indeed that we have an institution, and a man at its head, who can bring to our city such an illustrious group of men—men who are willing to give up their work and give their time to come here in order to help this Race Betterment meeting and to give us the benefit of their knowledge in carrying on this splendid work. I do not think we have ever had anything in our city that has attracted more attention than this Conference, and rightfully so, for, in the few moments that these illustrious scientists have taken, they have expressed years of thought and conclusions. We are all thankful to those who have taken part, and we want them to know we appreciate sincerely their kindness in giving us the fruits of their labors."

EDUCATIONAL ADVANCES TO BE APPLIED

Dr. William G. Coburn, Superintendent of Schools for the City of Battle Creek, added the following to the expressions of appreciation in behalf of the community:

"It was my pleasure to attend the First Race Betterment Conference fourteen years ago, and I cannot help but marvel at the progress made during this short period, as shown by the character of the addresses given in the several sessions of the Conference.

"As a school man I have been very much interested in the movement better to understand the emotional side of a child's nature. In the past we have spent most of our time investigating and measuring the intellectual; we have paid very little attention to the emotional nature. Some of the papers read before this Conference have thrown a flood of light upon this new study, and it seems to me that it is now our business to make use of this great mass of original investigation that has been brought before us by studying more thoroughly these new ideas and applying them to our educational needs, in promotion of a Better Race.

"I wish also to pay my tribute to the man who initiated this series of Race Betterment Conferences—Dr. John Harvey Kellogg. I have known Doctor Kellogg for over thirty years, and have always found him interested in the public schools of the country. He has been untiring in his efforts to build up the Race by writing text books for young people and by urging at every opportunity for better living among them. I have also found him ever ready and willing to help us in the attempt to build up healthier bodies—in furnishing open-air playgrounds, violet-ray machines for anemic children, nurses and food for the undernourished children, and in assisting in procuring parks and playgrounds for our boys and girls. Doctor Kellogg has always stood for better buildings and better equipment for the schools. I wish here to express my personal appreciation of all the things that he has done for the Betterment of the Race in general and particularly of what he has done for the boys and girls of Battle Creek."

RACE BETTERMENT IN BATTLE CREEK ONE HUNDRED YEARS AGO

In telling of eugenics among the Quakers, Mr. William G. Merritt, son of one of the pioneer Quaker settlers of Battle Creek, called attention to the appropriateness of holding meetings on Race Betterment at the Battle Creek Sanitarium, which stands upon the ground that was cleared and for several years occupied as a home by Mr. Merritt's father. He said:

"Nearly one hundred years ago the Society of Friends, which builded here, planned on these acres some of the same race benefits that today you are advocating. They also acted according to the best light of their times. Good form was their word of approbation and

measure of conduct. That their ideals were high I presume you know. What today you would call disgenics, they called 'not good form.'

"Among these Quakers the phrases, 'in good form,' and 'not in good form,' were quiet and smooth reminders of the permissible and non-permissible. They were reminders of what the Fathers and Elders had registered as their ideals of what could and what could not be tolerated. Their much-used phrase, 'in good form,' served as a guide of conscience, a condensed book of by-laws for human conduct and approved motives. I need not say to you that eugenics as a blunt technical word is of very recent coinage. The activating spirit among the Society of Friends was the same as yours, a frank and plain-spoken desire for ever improving offspring. Careful and suitable selection of life mates thus was made possible. Institutional church marriage was made to function according to the best light of the times. This among them was a perfected and working system two hundreds years ago in the early Colonies, and for many years before that in England.

"So the spirit of these meetings, centering as it does around the great idea of better offspring, is not new to the location now given over to the buildings of the Sanitarium. An early center of culture revolved around a five-foot shelf of books brought here by that lovable first settler.

"The Society of Friends was more than a conference. It was a close corporation. It was a league that persisted for two hundred and fifty years. It was on its inception a protest and loud speaker denouncement against the grossness of the time. Although these Quakers were a wee minority, they quarantined themselves against the undesirables of the period. They inoculated themselves in favor of self control, and lived up to their precepts. I have noted the words by previous speakers, 'great lack of self restraint on the part of the younger generation.' If I have listened aright, your deliberations put into a few words would be, 'give us a world of people with self restraint.' The Quakers were consistent; they ever lived this life of self restraint.

"They were the abolitionists. Lincoln's proclamation ending slavery in this land was the culmination of that movement. Their plea for religious tolèrance was also bearing fruit throughout the land about this time. Their two hundred and fifty years of building for a better and healthier man had succeeded, and no longer was there need to remain quarantined away from the people about them. They—those in these parts I speak of—laid away their distinguishing dress and comingled in their various communities.

"Eugenics thus had a start here one hundred years ago. To be specific, on the hilltop that is a part of the Battle Creek Sanitarium Annex

grounds was the home of a prominent Quaker, a leader and intellectualist of his time, friend of the black man in slavery days, and the settlement's inspiration in matters of good form. Indeed the spirit of Race Betterment is long and well planted on this hilltop and the grounds hereabouts, for here were often seen the Quaker Fathers, among whom was much used the watchword that stood for eugenic principle and purpose."

MESSAGES RECEIVED FROM FOREIGN COUNTRIES

CANADA

Hon. Forbes Godfrey, M.D., Minister of the Department of Health and Labour, *Ontario, Canada.*

"Owing to the fact that Parliament has been summoned and to the amount of legislative work in connection with my Departments, it will be impossible for me to take advantage of this invitation, for which I am sincerely sorry."

EGYPT

Mahmoud Samy Pasha, Egyptian Minister, *Royal Legation of Egypt, Washington, D. C.*

"It is a chance that one should never miss, but unfortunately, I am tied up with previous engagements which will prevent me from attending. The subjects that will be discussed are extremely interesting and I shall be greatly obliged if you can send me copies of the Proceedings of the Conference."

ENGLAND

Sir Andrew Balfour, Director London School of Hygiene and Tropical Medicine, *London, England.*

"Please accept my best wishes for the success of your Conference, which I note will deal with matters of great importance to the welfare of mankind."

Dean W. R. Inge, St. Paul's Cathedral, *London, England.*

"Alas, Michigan is too long a journey for me, and I have nothing new to contribute on Nature and Nurture. I hope the Conference will have a great success."

Sir Arthur Keith, Royal College of Surgeons, *London, England.*

"It is a great feast you spread before the Third Race Betterment Conference, and I am very sorry that I cannot be present to enjoy it—owing to many engagements here, but I wish it every success."

Dr. A. V. Hill, University College, *London, England.*

"I am grateful for the compliment implied in your letter of November 29th last, inviting me to attend the Third Race Betterment Conference in January next. I am sorry that it is quite out of the question for me to come now, but you have all my wishes for a successful meeting."

Sir George Newman, Ministry of Health, Whitehall, *London, England.*

"I have received your letter of November 29th, inviting me to attend your Race Betterment Conference, which is very kind of you, but I regret that it is quite impossible for me to accept."

H. G. Well's Secretary, 614 Stermin's, Westminster, S. W. 1, *London, England.*

"I have to thank you for your invitation addressed to Mr. H. G. Wells, and regret to inform you that he is abroad for the whole winter and would not be able to be present at the Conference.

FRANCE

Dr. Claude Regaud, Curie Foundation, Université de Paris, *Paris, France.*

"I regret greatly that it is impossible for me to come to Battle Creek in January. I am greatly interested in all measures tending toward the betterment of the human race, and approve without reservations the tentative program sent me."

SWITZERLAND

Dr. Frank G. Boudreau, League of Nations, *Geneva, Switzerland.*

Cable—Regret impossible attend Conference for which hope complete success. Letter follows.

Dr. A. Rosselet, Lausanne, Switzerland.

Cable—Many regrets. Impossible to come. Letter follows.

Dr. A. Rollier, Leysin, Switzerland.

"I much appreciate your kind invitation and the honor conferred on me in asking me to take part in your meeting, the program of which interests me profoundly, particularly as regards the degenerative tendencies of the race and the means of checking them.

"I sincerely wish you full success for the good result of the meeting, and with renewed thanks and regrets, believe me, etc.—"

MEXICO

Dr. Alfonso Pruneda, Rector de la Universidad Nacional, *Mexico, D. F.*

"University accepts kind invitation to Conference. Sending as delegate Doctor Miranda. Please present my cordial greetings."

Dr. Ulises Valdes, President Associacion Medica Mexicana, *Mexico City, Mexico.*

"I regret sincerely that it is impossible for me to attend the Conference. Nevertheless, desiring to be honored by accepting your kind invitation, I take pleasure in sending my personal representative, and the representative of the Mexican Medical Association, and of the National University. With sincere thanks for your kind invitation, etc."

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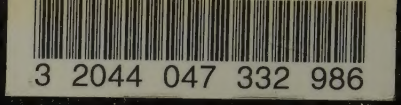
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